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October 2009

# FORMERLY USED DEFENSE SITES

The U.S. Army Corps  
of Engineers Needs to  
Improve Its Process  
for Reviewing  
Completed Cleanup  
Remedies to Ensure  
Continued Protection



GAO

Accountability \* Integrity \* Reliability

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Highlights of [GAO-10-46](#), a report to the Committee on Armed Services, House of Representatives

## Why GAO Did This Study

The Department of Defense (DOD) estimates that cleaning up known hazards at the over 4,700 formerly used defense sites (FUDS)—sites transferred to other owners before October 1986—will require more than 50 years and cost about \$18 billion. This estimate excludes any additional needed cleanup of emerging contaminants—generally, those not yet governed by a health standard. DOD delegated FUDS cleanup responsibility to the U.S. Army Corps of Engineers (Corps).

In addition to FUDS, DOD is responsible for cleaning up about 21,500 sites on active bases and 5,400 sites on realigned or closed bases. The House Armed Services Committee directed GAO to examine (1) the extent to which the Corps reevaluates sites to identify emerging contaminants; (2) how DOD allocates cleanup funds; (3) how the Corps prioritizes FUDS for cleanup; and (4) FUDS program overhead costs. GAO analyzed nationwide FUDS property and project data; policies, guidance and budget documents; and interviewed DOD and Corps officials.

## What GAO Recommends

GAO recommends that the Corps conduct 5-year reviews for sites with emerging contaminants and is making recommendations for better management of these reviews. DOD generally agreed with the recommendations, but did not agree to conduct reviews not specifically required by law. We continue to believe additional reviews are needed, consistent with EPA guidance.

View [GAO-10-46](#) or key components. For more information, contact John B. Stephenson at (202) 512-3841 or [stephensonj@gao.gov](mailto:stephensonj@gao.gov).

## FORMERLY USED DEFENSE SITES

### The U.S. Army Corps of Engineers Needs to Improve Its Process for Reviewing Completed Cleanup Remedies to Ensure Continued Protection

## What GAO Found

The Corps has not often re-examined sites after they have been cleaned up to determine whether emerging contaminants are present or need to be addressed. Generally, the Corps reevaluates sites only when requested by states or others, or when reviewing the completed remedy to ensure its continuing protectiveness. Such reviews are required every 5 years for sites where the chosen remedy does not allow for unlimited use and unrestricted exposure. Corps officials said that they had not received many requests to re-examine sites and few FUDS had required 5-year reviews. Reports on the 15 5-year reviews completed as of May 2009 within four Corps divisions indicated that the Corps has not consistently (1) conducted required 5-year reviews on time, (2) conducted reviews when they are not required but may be appropriate, as EPA recommends, and (3) submitted reports on these reviews for technical evaluation, as required by Corps policy. Also, DOD and the Corps lack accurate, complete information on the status of these reviews. Without timely, accurate, and complete reviews, the Corps cannot ensure that remedies continue to protect human health and the environment.

DOD proposes funding to clean up defense sites based on the department's environmental restoration goals and obligations are generally proportional to the number of sites in each site category. Funding is directed toward reducing risks to human health and the environment, among other goals. The Army, Navy, Marine Corps, Air Force, and Defense Logistics Agency each determine the funding requirements to clean up sites based on these goals.

The Corps prioritizes individual FUDS for cleanup on the basis of risk and other factors. The Corps assigns each site a risk level, considering such factors as the presence of hazards, the potential for human contact, and the concentrations of contaminants and their potential for migrating, among others. According to DOD officials, sites' risk levels are the single most important criterion in determining cleanup priorities. However, the Corps also takes into account specific FUDS program goals, and other factors—such as regulators' and the public's concerns—that can influence the Corps' decisions about which sites to address first. Consequently, high risk sites are not always addressed before low risk sites.

Direct program management and support costs for the FUDS program have decreased slightly in recent years, mostly due to structural changes in the program. The Corps' obligations for FUDS direct program management and support costs have declined from 11.0 percent of total program obligations in fiscal year 2004 to 9.0 percent in fiscal year 2008. In addition, to further reduce certain components of these costs to make more funds available for FUDS cleanup, the Corps reduced the number of employees managing the program and the number of districts responsible for FUDS from 22 to 14. Furthermore, Corps officials told GAO that they have implemented a number of controls—such as assigning tracking codes—to ensure that program management and support funds are spent only on approved items.

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## Abbreviations

|          |  |
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| ARAR     | applicable or relevant and appropriate requirements                      |
| BD/DR    | building demolition and debris removal                                   |
| BRAC     | Base Realignment and Closure   |
| CERCLA   | Comprehensive Environmental Response,<br>Compensation, and Liability Act |
| CON/HTRW | containerized hazardous, toxic, and radioactive waste                    |
| Corps    | U.S. Army Corps of Engineers   |
| DERP     | Defense Environmental Restoration Program                                |
| DOD      | Department of Defense  |
| DSMOA    | Defense State Memorandum of Agreements                                   |
| EPA      | Environmental Protection Agency  |
| FUDS     | formerly used defense sites  |
| FUDSMIS  | Formerly Used Defense Sites Management Information<br>System             |
| FY       | fiscal year  |
| HTRW     | hazardous, toxic, and radioactive waste                                  |
| IRIS     | Integrated Risk Information System                                       |
| IRP      | Installation Restoration Program   |
| MMRP     | Military Munitions Response Program                                      |
| MROSD    | Midpeninsula Regional Open Space District                                |
| MRSP     | munitions response site prioritization protocol                          |
| NCP      | National Oil and Hazardous Substance Pollution<br>Contingency Plan       |
| PPB      | parts per billion  |
| RIP/RC   | remedy in place or response complete                                     |
| RRSE     | relative risk site evaluation  |
| SMAP     | Statewide Management Action Plan   |
| TCE      | trichloroethylene  |

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United States Government Accountability Office  
Washington, DC 20548

October 29, 2009

The Honorable Ike Skelton  
Chairman  
The Honorable Howard P. “Buck” McKeon  
Ranking Member  
Committee on Armed Services  
House of Representatives

The U.S. Army Corps of Engineers (Corps) has invested about \$4.4 billion since fiscal year (FY) 1984 to address contamination and hazards at formerly used defense sites (FUDS). These sites are located on properties that were under the jurisdiction of the Department of Defense (DOD) and owned by, leased to, or otherwise possessed by the United States prior to October 17, 1986, but have since been transferred to states, local governments, federal entities, and private parties.<sup>1</sup> They can range in size from less than an acre to many thousands of acres and are used as parks, airports, industrial and commercial facilities, schools, and homes, among other uses. FUDS can include hazards such as unsafe buildings, toxic and radioactive wastes, hazardous wastes in storage containers, ordnance, and explosive compounds. Under the Defense Environmental Restoration Program (DERP), DOD is authorized to identify, investigate, and clean up certain environmental contamination and address other hazards at both FUDS and active installations. In the case of some FUDS, they have been outside DOD jurisdiction for more than 100 years. DOD delegated its authority for administering the cleanup of FUDS to the Department of the Army, which, in turn, delegated its execution to the Corps. As of September 30, 2008, the Corps had identified over 4,700 sites that are eligible for cleanup under the program.

The Corps estimates that, at current funding levels, cleaning up known DOD contamination and hazards at FUDS will take more than 50 years and cost about an additional \$18 billion. However, this timeline and cost estimate may expand if further cleanup at FUDS is required due to changes in regulations, or if 5-year reviews of site cleanup reveal the need

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<sup>1</sup>DOD notes that this jurisdiction extends to governmental entities that are the legal predecessors of DOD or the components—Army, Navy and Marine Corps, Air Force, and Defense Logistics Agency.



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for additional actions, such as to address emerging contaminants.<sup>2</sup> DOD defines an emerging contaminant as a contaminant that (1) has a reasonably possible pathway to enter the environment; (2) presents a potential unacceptable human health or environmental risk; and (3) either does not have regulatory standards based on peer-reviewed science or has regulatory standards that are evolving due to new science, detection capabilities, or exposure pathways.<sup>3</sup>

The House Armed Services Committee report accompanying the National Defense Authorization Act for FY 2009 directed us to conduct a study of DOD's efforts to clean up FUDS. As discussed with the committee staff, we examined (1) how the Corps addresses emerging contaminants at FUDS, and the extent to which the Corps reevaluates sites during 5-year reviews or other circumstances to determine the need to address emerging contaminants; (2) DOD's process for proposing funding for cleanup at FUDS and other sites in the defense cleanup program; (3) the Corps' criteria for prioritizing FUDS for cleanup and how closely the Corps follows these criteria; and (4) the components and total amounts of management and support costs for the FUDS program, how these costs have changed over time, and the Corps' accountability measures for these costs. In addition, at the request of the committee, this report provides information on the status of the Corps' cleanup efforts at the former Almaden Air Force Station, a FUDS located near San Jose, California (see app. I).

In conducting our work, we reviewed program information obtained from officials with DOD's DERP; the Department of the Army; the Corps' headquarters; the Corps' Environmental and Munitions Center of Expertise; 4 of the 7 Corps military divisions; and 4 of the 14 districts responsible for FUDS program execution. We selected the 4 divisions based on geographic dispersion, the number of FUDS within a division,

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<sup>2</sup>The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 requires that reviews be conducted not less than every 5 years after the start of remedial action when the chosen remedy results in any hazardous substances, pollutants, or contaminants remaining at the property. The Environmental Protection Agency has interpreted this statutory language to mean that a 5-year review is required to assess the continuing protectiveness of a remedy when a property has not been cleaned up to a level that allows for unlimited use and unrestricted exposure.

<sup>3</sup>This definition was developed in consultation with Environmental Protection Agency and the Environmental Council of the States—the national nonprofit, nonpartisan association of state and territorial environmental agency leaders.

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and planned obligations for FY 2009. Within these divisions, we selected four districts with FUDS program management responsibilities. To evaluate the Corps' process for addressing emerging contaminants and prioritizing sites for cleanup, we reviewed and analyzed the nationwide property and project data in the Corps' FUDS Management Information System (FUDSMIS) through September 30, 2008. We assessed the reliability of relevant fields in this database. When we found inconsistencies, we worked with DOD and Corps officials to correct the discrepancies before conducting our analyses. We determined that the data needed for our analyses were sufficiently reliable for the purposes of our report. We reviewed relevant sections of key laws, regulations, policies, guidance, DOD budget justification documents, and DOD's Defense Environmental Programs Annual Report to Congress. We also obtained information on the Corps' completed and planned 5-year reviews. In addition, we interviewed officials of the Environmental Protection Agency (EPA) and two state organizations—the National Governors Association and the Association of State and Territorial Solid Waste Management Officials—to obtain their perspectives on FUDS cleanup.

We conducted this performance audit from September 2008 through October 2009, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. A more detailed description of our scope and methodology is presented in appendix II.

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## Background

Under DERP, DOD is required to carry out a program of environmental restoration activities at sites located on former and active defense installations that were contaminated while under DOD's jurisdiction. The goals of the program include the identification, investigation, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants; the correction of other environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to public health or welfare or the environment; and demolition and removal of unsafe buildings and structures. To that end, DOD has established performance measures and goals and identified over 31,600 sites that are eligible for cleanup, including about 4,700 FUDS, 21,500 sites on active installations, and 5,400 sites on installations that have been closed or are designated to be closed or realigned under the Base Realignment and Closure (BRAC)

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process.<sup>4</sup> The DERP was established by section 211 of the Superfund Amendments and Reauthorization Act of 1986 which amended the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. In implementing the DERP, DOD is required to carry out its activities addressing hazardous substances, pollutants, or contaminants in a manner consistent with section 120 of CERCLA.<sup>5</sup> Funding for DERP cleanup activities comes from the Environmental Restoration and BRAC accounts. The Environmental Restoration accounts fund cleanup activities at FUDS and active sites and the BRAC accounts fund cleanup activities at certain closing or realigning installations.<sup>6</sup>

To carry out the DERP at FUDS, DOD has established three major program categories: the Installation Restoration Program, the Military Munitions Response Program, and the Building Demolition/Debris Removal Program. Specifically:

- *Installation Restoration Program (IRP)*. DOD established the IRP in 1985 to address the release of hazardous substances, pollutants, or contaminants resulting from past practices that pose environmental health and safety risks on both active sites and FUDS. For FUDS, the IRP includes (1) hazardous, toxic, and radioactive waste (HTRW) sites and (2) containerized hazardous, toxic, and radioactive waste (CON/HTRW) sites, such as sites with transformers and aboveground or underground storage tanks. In FY 2008, 2,621 FUDS were included in the IRP. DOD has developed performance measures to assess progress toward the agency's IRP goals. These goals are based on the achievement of certain CERCLA cleanup phases and include progress toward achieving DOD milestones of "remedy in place" and/or "response complete" at installations, and

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<sup>4</sup>To enable DOD to close unneeded bases and realign others, the Congress enacted legislation that instituted five separate BRAC rounds in 1988, 1991, 1993, 1995, and 2005. Independent commissions established for each BRAC round made specific recommendations to the Senate and House Committees on Armed Services for the 1988 round and, thereafter, to the President, who in turn, sent the Commissions' recommendations and his approval to the Congress.

<sup>5</sup>Section 120 of CERCLA makes the law applicable to federal government entities to the same extent it is applicable to nongovernmental entities, and establishes procedures governing the identification, assessment, evaluation, and cleanup of releases at federal facilities.

<sup>6</sup>The DERP establishes five separate environmental restoration accounts which receive separate appropriations: one for Defense-wide purposes, and one each for Army, Navy, Air Force, and FUDS. DOD notes that the FUDS account is managed by DOD, with the Army serving as Executive Agent.

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progress in reducing overall risks. Specific IRP targets are included in DOD's annual report to the Congress.

- *Military Munitions Response Program (MMRP)*. DOD established the MMRP in September 2001 as a separate program to focus on addressing potential explosive and environmental hazards associated with munitions sites on both active installations and FUDS, due to the unique issues associated with munitions sites. The MMRP includes sites with munitions and explosives of concern, munitions constituents, and chemical warfare materiel.<sup>7</sup> In FY 2008, 1,661 FUDS were included in the MMRP. The objectives of the program include compiling a comprehensive inventory of military munitions sites, establishing a prioritization protocol for cleanup work at these sites, and establishing program goals and performance measures to evaluate progress. In December 2001, shortly after DOD established the program, the Congress passed the National Defense Authorization Act for FY 2002, which, among other things, required DOD to develop, by May 31, 2003, an initial inventory of defense sites, other than military ranges still in operation, that are known or suspected to contain military munitions and to provide annual updates thereafter, among other requirements. DOD provides these updates as part of its Defense Environmental Programs Annual Report to Congress.
- *Building Demolition/Debris Removal Program (BD/DR)*. To address the demolition and removal of unsafe buildings or structures, DOD established the BD/DR Program. In FY 2008, the Corps had 423 FUDS in the BD/DR program. Because of the small number of FUDS in the BD/DR Program, DOD measures and reports cleanup progress at BD/DR sites with the IRP program.<sup>8</sup>

Figure 1 shows these three program categories and the types of cleanup projects within each category at FUDS. A FUDS property may have multiple types of cleanup projects, which we refer to as "sites." For example, a single FUDS property could have a munitions site; a building

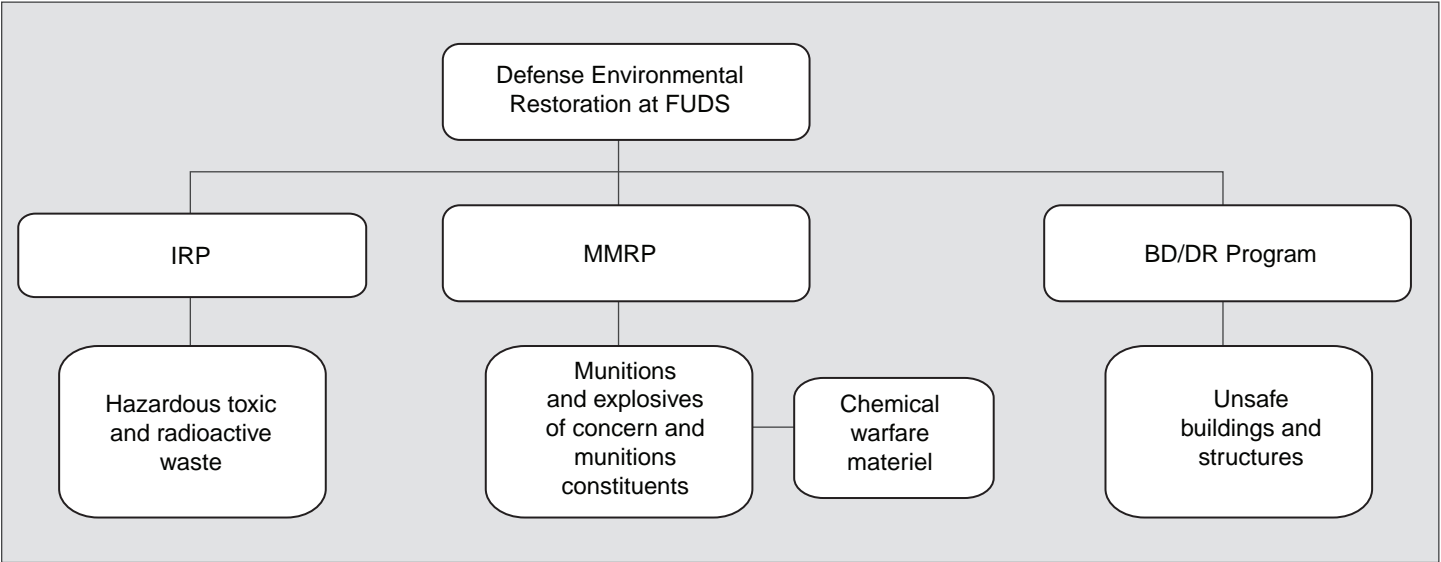
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<sup>7</sup>Munitions constituents are defined as any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. 10 U.S.C. § 2710(e)(3) (2006).

<sup>8</sup>In the BD/DR program, the Corps reviews documentation of the condition of the buildings and evidence of DOD debris at the time of disposal or transfer from DOD jurisdiction. According to DOD, unsafe and hazardous conditions resulting from subsequent owners' neglect or lack of maintenance are not eligible to be addressed under the FUDS program.

demolition/debris removal site; and a hazardous, toxic, and radioactive waste site.

Figure 1: DERP Program Categories and Project Types at FUDS



Source: GAO analysis of DOD information.

DOD is responsible for cleaning up its releases of hazardous substances under DERP, in accordance with CERCLA.<sup>9</sup> The remedy chosen for such a release must meet certain standards for contaminants set under state or federal laws or regulations.<sup>10</sup> If there is no standard for a given contaminant, DOD must still achieve a degree of cleanup, which at a minimum, assures protection of human health and the environment. Thus, the absence of a federal or state standard for the cleanup of a particular

<sup>9</sup>A “hazardous substance” is defined by CERCLA as a substance that is listed as such under CERCLA, in addition to substances designated as hazardous under the Clean Water Act, hazardous waste as defined by the Resource Conservation and Recovery Act, hazardous pollutants designated under the Clean Air Act, and substances that are deemed imminent hazards under the Toxic Substances Control Act.

<sup>10</sup>Cleanups must meet standards that are legally applicable or relevant and appropriate (ARAR). ARARs include standards promulgated under any federal environmental law, in addition to standards promulgated under certain state laws or regulations that are more stringent than federal law and are identified to the entity conducting the cleanup in a timely manner.

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hazardous substance does not negate DOD's responsibility to clean up releases of that substance.

Currently, all seven of the Corps' geographic military divisions and 14 of its 45 districts within these divisions have responsibilities for identifying, investigating, and cleaning up hazards at FUDS. The Corps' Environmental and Munitions Center of Expertise provides specialized technical assistance to help the Corps' divisions and districts execute their responsibilities. The Corps' FUDS program policy follows DERP management guidance, provides specific policy and guidance for managing and executing the FUDS program, and applies to all Corps elements engaged in FUDS program activities.<sup>11</sup> Depending on the types of hazards involved and their severity, either a state environmental regulatory agency or EPA is the lead regulator at a FUDS. The lead regulator is responsible for providing regulatory oversight of the Corp's actions to clean up FUDS. In general, EPA is the lead regulator for all sites, including FUDS properties, on EPA's list of some of the most contaminated sites in the country—the National Priorities List. Most FUDS are not on the National Priorities List, and states are typically the lead regulators for these FUDS properties.<sup>12</sup>

To be eligible for FUDS cleanup under the DERP and FUDS program policy, a property must have been under the jurisdiction of DOD and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances or other hazards prior to October 17, 1986. In deciding which actions, if any, need to be taken at FUDS, the Corps uses the process outlined in the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) for identifying, investigating, and cleaning up releases of hazardous substances under CERCLA.<sup>13</sup> The Corps describes its usual process in the following, generally sequential, phases:

- Preliminary assessment—The Corps uses available information, including a search of historical records, to determine whether the property was ever under the jurisdiction of DOD and owned or controlled by the United States, and if hazards caused by DOD's use may be present. If the Corps

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<sup>11</sup>Engineering Regulation 200-3-1, May 10, 2004.

<sup>12</sup>As of October 8, 2008, 28 FUDS were listed on the National Priorities List.

<sup>13</sup>The NCP contains procedures and standards for implementing CERCLA 40 C.F.R. pt. 300 (2009).

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determines that the property was under the jurisdiction of DOD and owned or controlled by the United States, but does not find evidence of any hazards caused by DOD, it designates the property as “no DOD action indicated.” If, however, the Corps determines that hazards caused by DOD prior to October 17, 1986, may be present, the Corps begins further study.

- Site inspection—The Corps inspects the site to confirm the presence and possible sources of hazards; to confirm that a release has occurred; or eliminate from further consideration those sites that pose no significant threat to public health or the environment. The site inspection builds upon the preliminary assessment and involves sampling to determine the nature of contamination, potential pathways of exposure, and recommendations for further action.
- Remedial investigation—The Corps conducts more rigorous sampling and analysis to determine the nature and extent of the release, evaluates the baseline risk to human health and the environment posed by the release, and determines if further response action is required to respond to an unacceptable risk.
- Feasibility study—The Corps analyses the feasibility of alternative remedies to respond to the release using the CERCLA remedy selection criteria and establishes the cleanup criteria for the remedial action.
- Proposed plan—The Corps proposes to the public and the lead regulator its recommendation for a remedial action to respond to the release and explains how it will satisfy the remedy selection criteria of CERCLA and the NCP.
- Remedy selection—The Corps issues a record of decision or decision document signed by an authorized agency official to formally select the remedial action to be taken to respond to the release and explains the elements of the remedy and the basis for its selection using the remedy selection criteria of CERCLA and the NCP.
- Remedial design—The Corps designs the remedy selected by the feasibility study.
- Remedial action construction—The Corps constructs the selected remedy. At the end of construction, the DOD’s milestone “remedy-in-place” is met when testing of the remedy shows that it will function as designed.

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- Remedial action operation—The Corps operates the selected remedy until the cleanup objective is achieved. At the end of operation, the DOD’s milestone, “response complete” is met.
  - Long-term management—The Corps may conduct ongoing environmental management for a number of years to ensure that the remedy continues to provide the protection it was designed to achieve for human health, safety, and the environment. Examples of long-term management activities are monitoring of a groundwater treatment system, maintenance of a landfill cap, and enforcement of land use controls. In addition, the NCP requires that the Corps, as the agency responsible for FUDS cleanup, conduct “5-year reviews” of sites not less than every 5 years after the start of remedial action, when the chosen remedy does not allow for unlimited use and unrestricted exposure. The Corps continues long-term management activities until they are no longer required.

DOD has also established a three-tiered process for identifying and evaluating changes in the information about emerging contaminants or how these contaminants are regulated that may affect DOD’s actions or decisions in several areas, including cleanup of contaminated sites. DOD’s Chemical and Material Risk Management Directorate manages this process, called “scan-watch-action,” and has developed watch and action lists of emerging contaminants (see table 1). The watch list identifies chemicals for which there is a potential for a regulatory change that may affect DOD and the action list includes chemicals for which there is significant potential for regulatory change that may affect DOD.



**Table 1: DOD’s Action and Watch Lists of Emerging Contaminants**

**Action List contaminants**

- Beryllium
- Hexavalent chromium (Chromium VI)
- Naphthalene
- Perchlorate
- Royal Demolition Explosive
- Sulfur hexafluoride<sup>a</sup>
- Trichloroethylene (TCE)

**Watch List contaminants**

- 1,4-dioxane
- Cadmium and compounds
- Cerium and compounds
- Cobalt and compounds
- Dioxins
- Lead compounds
- Manganese and compounds
- Nanomaterials<sup>a</sup>
- Nickel
- Perfluorooctanoic acid
- Perfluorooctyle sulfonate
- Di-nitrotoluene
- Tetrachloroethylene
- Tungsten
- Tungsten alloys

Source: DOD.

<sup>a</sup>DOD officials told us that sulfur hexafluoride and nanomaterials are not relevant to FUDS.

## The Corps Uses the CERCLA Process to Address Emerging Contaminants at FUDS, but Has Gaps in its 5-Year Review Procedures

According to DOD and Corps officials, the Corps addresses emerging contaminants at FUDS the same way it does other contaminants—by using the established CERCLA process. However, using this process has not often led the Corps to re-examine sites after response actions are completed to determine whether emerging contaminants are present or need to be addressed. Further, our analysis of information on the 5-year reviews completed in 4 divisions identified problems with the Corps’ 5-year review procedures. We found that (1) reviews were not completed on time; (2) DOD and the Corps do not have accurate, complete information on how many 5-year reviews are required, completed, or planned; (3) divisions are inconsistent in their approaches to conducting 5-year reviews for sites where they are recommended, but not required; and (4) review

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reports did not always receive the technical review by Corps experts required by Corps policy.

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## The Corps Uses the CERCLA Process for Investigating and Responding to Emerging Contaminants

The Corps identifies and addresses emerging contaminants at FUDS, as it does other contaminants—using the CERCLA process for identifying, investigating, and cleaning up releases of hazardous substances that is outlined in the NCP. Corps officials told us that in their initial evaluations of FUDS under CERCLA, the agency tested for most known emerging contaminants at those sites where there was a reason to suspect these contaminants were present and caused by DOD. They also told us that the Corps would sample a site for a contaminant, if appropriate, regardless of whether there is a federal or state standard for it. Appendix III provides information on the occurrence of emerging contaminants in groundwater, surface water, soil, and sediment at HTRW FUDS, based on the samples taken as of September 30, 2008.

To make informed decisions on which contaminants to sample for at a site, the Corps' districts review records of DOD's past use of the site. In 2002, we reported that the Corps lacked comprehensive guidance on the typical hazards that may be present at DOD properties as a result of certain types of DOD activities.<sup>14</sup> However, the Corps subsequently developed guidance, and between 2003 and 2008, issued a series of reports identifying potential chemicals that past military activities may have released. District officials told us that they use this guidance, called "Common Operations Reports," in conjunction with historical information about a site to determine which contaminants may have been released there. After sampling for contaminants at a site, the Corps uses the sampling results and other site-specific information to assign relative risk levels to sites. These relative risk levels are not based on a comprehensive risk assessment, but are a tool used to prioritize the site for cleanup based on information collected early in the cleanup process.

After further defining the nature and extent of contamination at a site, the Corps then uses scientific information on contaminants, sampling results, and other site-specific data—such as information on exposure pathways, potential receptors, and site use—to conduct more comprehensive site-

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<sup>14</sup>GAO, *Environmental Contamination: Corps Needs to Reassess Its Determinations That Many Former Defense Sites Do Not Need Cleanup*, [GAO-02-658](#) (Washington, D.C.: Aug. 23, 2002).

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specific risk assessments that are to be used in making cleanup decisions for the site. This requires the Corps to identify and select appropriate contaminant toxicity values to use in assessing risks to human health and the environment.<sup>15</sup> The identification of toxicity values is a crucial step that presents special challenges for emerging contaminants, for which information on human health effects may be insufficient, limited, or evolving. DOD's and EPA's preferred source for the fundamental toxicity information needed to develop human health risk assessments is EPA's Integrated Risk Information System (IRIS), a database that contains EPA's scientific position on the potential human health effects of exposure to more than 540 chemicals. However, IRIS does not contain final assessments for some emerging contaminants.<sup>16</sup> For example:

- naphthalene, a component of jet fuel that has contaminated many military bases;
- trichloroethylene (TCE), a solvent widely used in industrial and manufacturing settings;
- cyclotrimethylenetrinitramine, which is also known as Royal Demolition Explosive, a highly powerful explosive used by the U.S. military in thousands of munitions;
- dioxin, a chemical that is often the byproduct of combustion and other industrial processes; and
- tetrachloroethylene, which is also known as perchloroethylene, a manufactured chemical widely used for dry cleaning fabrics, metal degreasing, and production of some consumer products and other chemicals.

DOD worked with EPA and the Environmental Council of States (ECOS) to develop a white paper in 2007 on the process to use for identifying and

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<sup>15</sup>Toxicity information includes, for example, the oral reference dose for noncancer health effects, which estimates the daily exposure to a chemical that is likely to be without an appreciable risk of deleterious effects during a person's lifetime.

<sup>16</sup>GAO, *Chemical Assessments: Low Productivity and New Interagency Review Process Limit the Usefulness and Credibility of EPA's Integrated Risk Information System*, [GAO-08-440](#) (Washington, D.C.: Mar. 7, 2008).

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selecting toxicity values when there are no values available from IRIS.<sup>17</sup> ECOS endorsed the white paper by a formal resolution of the member states. DOD formalized the process outlined in this paper with a June 2009 policy on emerging contaminants.<sup>18</sup>

Using the site-specific risk assessments, the Corps develops site-specific, risk-based cleanup levels for contaminants at FUDS. Under CERCLA, the Corps must choose a cleanup alternative that, at a minimum, assures protection of human health and the environment. In developing a protective remedy, the Corps considers generally acceptable risk ranges<sup>19</sup> and must choose a remedy which will comply with the applicable or relevant and appropriate requirements (ARAR) that have been identified for the site. The Corps and most FUDS state regulators identify ARARs based on site-specific factors such as the contaminants present, site location and physical features, and response actions being considered. Federal or state standards are not automatically applied to a site—they must first be identified as ARARs for the site. ARARs, which are used as a starting point to assess the protectiveness of a remedy, consist of the following two sets of requirements:

- *Applicable requirements* are cleanup standards; standards of control; and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.
- *Relevant and appropriate requirements* are requirements that do not meet this definition of “applicable,” but address situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. State standards must be identified in a timely manner and be more stringent than federal requirements to be considered relevant and appropriate.

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<sup>17</sup>ECOS-DOD Sustainability Work Group, Emerging Contaminants Task Group, *Identification and Selection of Toxicity Values/Criteria for CERCLA and Hazardous Waste Site Risk Assessments in the Absence of IRIS Values* (Washington, D.C., April 2007).

<sup>18</sup>DOD Instruction Number 4715.18, June 11, 2009.

<sup>19</sup>EPA and Corps guidance define acceptable risks as an excess upperbound lifetime cancer risk of  $10^{-4}$  to  $10^{-6}$ , or for noncancer health risks, a hazard index below 1.

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If there are no ARARs for contaminants at a site, cleanup levels for the contaminants are established based on the Corps' site-specific risk assessments. In addition, as part of the ARAR identification process, the Corps also identifies other information that may be considered under CERCLA in establishing cleanup levels. This information is not legally binding and can include nonpromulgated guidelines, advisories, or guidance issued by states or the federal government—for example, drinking water health advisories issued by EPA.

After the Corps selects a remedy under CERCLA, if the remedy results in any hazardous substances, pollutants, or contaminants remaining at the site, the Corps must review the remedy no less often than each 5 years after the remedial action was initiated to assure that the remedy is protecting human health and the environment. EPA, the primary regulatory agency for CERCLA, interprets the 5-year review requirement to apply when the remedy for a site will not clean up the site to a level that allows for unlimited use and unrestricted exposure. In addition, EPA guidance notes that 5-year reviews are appropriate, even if not required, for sites where the cleanup will eventually allow unlimited use and unrestricted exposure, but will require more than 5 years to complete.

EPA and Corps guidance recommend that 5-year review reports include, among other things, a history of the site, a description of the response actions, a summary of the review process, and certain analysis. This analysis should identify whether (1) the response action—for example, a groundwater treatment system to reduce contaminant concentrations, or land use controls to prevent access to a site—is functioning as intended; (2) assumptions—such as exposure assumptions, toxicity of contaminants, and cleanup levels—used at the time of selecting the response action are still valid; and (3) any new information—such as on changes in the use and accessibility of the site—that indicates the response action may no longer be protective of human health, safety, and the environment.<sup>20</sup> In addition, although CERCLA does not require the collection of new samples to determine the presence of additional contaminants during the 5-year review, the review provides a mechanism

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<sup>20</sup>The Corps' FUDS program policy does not specify what the 5-year review reports are to include; instead, it refers the districts generally to EPA's *Comprehensive Five-Year Review Guidance* (2001) and the Corps' Engineer Pamphlet on *Recurring Reviews of Ordnance and Explosives (OE) Response Actions* (2003) for military munitions response actions. These two guidance documents specify recommended procedures for developing and implementing 5-year reviews.

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to consider available evidence of new contamination that is brought to the attention of the districts. In this regard, EPA guidance instructs those conducting 5-year reviews to consider whether new contaminants have been identified when evaluating the continuing validity of the assumptions used at the time of remedy selection. Finally, EPA and Corps guidance recommend that the 5-year review reports include recommendations for follow-up actions, if necessary, to address identified deficiencies. The Corps may need to modify the cleanup actions at a site if the 5-year review identifies significant changes in contaminant or site information that call into question the protectiveness of the remedy, as determined by a comparison of site-specific risks with the generally acceptable risk ranges.<sup>21</sup>

In addition to using the CERCLA process, the Corps also uses EPA, DOD, and Army policies or guidance specific to certain contaminants or issues, including perchlorate and TCE, emerging contaminants that are of particular concern to DOD because they have significant potential to affect people or DOD's mission. Appendix IV provides more information on these contaminants at FUDS.

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### The Corps Considers New Information on Contaminants in its 5-Year Reviews, but Has Problems with its Review Procedures

Our analysis of information on the Corps' 5-year reviews for FUDS in 4 divisions identified the following problems with the Corps' review process: (1) the reviews were not completed on time; (2) DOD and the Corps lack accurate, complete information on these reviews; (3) Corps divisions are inconsistent in their approaches to conducting 5-year reviews for sites where they are recommended, but not required; and (4) the reports resulting from these reviews did not always receive the technical review by Corps experts as required by Corps policy. These 5-year reviews can be conducted in the remedial action construction, remedial action operation, and long-term management phases. These reviews provide a mechanism for identifying and responding to changes that may occur, such as new scientific knowledge, regulation of emerging contaminants, or the discovery of additional munitions at a site. Corps officials told us that, to date, few FUDS have required 5-year reviews, due to a variety of factors. For example:

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<sup>21</sup>As previously noted, EPA and Corps guidance define acceptable risks as an excess upperbound lifetime cancer risk of  $10^{-4}$  to  $10^{-6}$ , or for noncancer health risks, a hazard index below 1.

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- The Corps strives to clean up FUDS to a level that allows unlimited use and unrestricted exposure, which does not require a 5-year review—preventing exposure to contaminants left in place can be more difficult at FUDS properties than active DOD installations because DOD no longer owns or controls FUDS properties and does not have the same ability to restrict land use.
  - The Corps has completed cleanup at a higher percentage of building demolition/debris removal sites and containerized waste sites than hazardous, toxic, and radioactive sites. This is because, while cleanup is under way at hazardous, toxic, and radioactive sites, these sites are typically much more complex than building demolition/debris removal sites and containerized waste sites, and significantly more time and investment is required to complete cleanup. Building demolition/debris removal sites do not generally require 5-year reviews because these types of sites involve unsafe buildings, or structures and generally not the hazardous substances, pollutants, or contaminants to which CERCLA applies. Containerized waste sites can require 5-year reviews, but Corps officials in 2 divisions told us that most of these sites were cleaned up to a level that did not require 5-year reviews. In addition, one division told us that most of the containerized waste site cleanups completed by the Corps to date were for petroleum storage tanks. Petroleum is not a hazardous substance, pollutant, or contaminant under CERCLA,<sup>22</sup> so 5-year reviews are not required for actions to address petroleum contamination at FUDS.<sup>23</sup>
  - In some divisions and for certain types of sites, the Corps has not yet reached the point at which 5-year reviews become required. For example, one division official told us that they have only recently begun completing cleanup of HTRW sites, and another division official said that most of the sites that might need a 5-year review have not yet been cleaned up. Further, many munitions sites have not yet reached the trigger date for 5-year reviews—the initiation of remedial actions—because they are still in the investigation phase. Corps’ guidance states that all FUDS where an ordnance and explosives response action is implemented require 5-year reviews.

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<sup>22</sup>42 U.S.C. § 9601(14), (33) (2006).

<sup>23</sup>DOD notes that petroleum contamination may be addressed by other applicable requirements, such as state requirements.

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Corps officials told us that the districts will be conducting more 5-year reviews in the future. For example, officials in the 4 districts we contacted told us that they will be responsible for completing a total of 30 5-year reviews from FY 2009 through 2014. As of May 2009, these districts had completed a total of 15 5-year reviews—5 for IRP sites and 10 for MMRP sites. However, our examination of information on these 15 reviews indicated that these districts have not consistently implemented the 5-year review process in accordance with CERCLA or Corps and EPA guidance. We found that:

- *5-year reviews were not always completed on time.*<sup>24</sup> For example, all of the five 5-year reviews conducted for IRP sites and at least five of the reviews for MMRP sites were completed late, with the reports being late by 3 months to 9 years.<sup>25</sup> In addition, for three of the five IRP sites for which 5-year reviews had been completed, we determined that the Corps incorrectly identified the trigger dates for initial 5-year reviews as the completion, rather than initiation, of the remedial action.<sup>26</sup> We also found that one additional review for an IRP site is already overdue by more than 3 years, and at least 3 additional reviews for MMRP sites are overdue by 1 to 5 years.<sup>27</sup> Corps officials cited a variety of reasons for these delays, including turnover of program and project managers; lack of internal staffing resources for conducting the reviews; and multiple report iterations resulting from lengthy internal and external reviews involving

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<sup>24</sup>EPA guidance provides that 5-year reviews which are required by statute occur no less often than 5 years after the initiation of the remedial action. Where no review is required but is instead recommended, EPA provides that the reviews occur no less often than 5 years after construction of the remedy is complete. Corps guidance specific to MMRP sites does not distinguish between required and policy reviews and provides, as EPA guidance does, that reviews occur no less often than 5 years after the initiation of the response action.

<sup>25</sup>We evaluated the timeliness of 5-year review reports for IRP sites, all of which were required by statute, using a due date of 5 years from the initiation of the remedial action. Reports on the MMRP sites did not indicate whether or not reviews were required. However, the reports were late regardless of whether the due date was calculated from the initiation or the completion of the response action. For one MMRP site, we relied on the trigger date listed in the 5-year review report because we were unable to identify the date of remedial or removal action.

<sup>26</sup>We were unable to evaluate whether the Corps correctly identified the trigger dates for initial MMRP 5-year reviews because in four of the five 5-year review reports we examined for MMRP sites, the Corps did not identify the trigger dates.

<sup>27</sup>Based on EPA and Corps guidance, we evaluated the timeliness of subsequent 5-year review reports for IRP and MMRP sites using a due date of 5 years from the signature date of previous reports.



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Corps staff, EPA headquarters and regional offices, and state regulators. Officials also cited program budget and resource constraints, with one district highlighting a higher programmatic emphasis on meeting DOD's goal of completing site inspections for MMRP sites by September 30, 2010.<sup>28</sup> In addition, the delay for the 5-year review for an IRP site at the Former Weldon Spring Ordnance Works in Missouri resulted from the discovery of additional contamination during the Corps' activities to close the site.

- *DOD and the Corps do not have accurate, complete information on how many 5-year reviews are required, completed, or planned for the FUDS program.* DOD and the Corps rely on data from FUDSMIS for program-wide information on the status of 5-year reviews at FUDS. To manage and implement the FUDS program, DOD, the Army, and the Corps use FUDSMIS to support planning, programming, budgeting, annual workplan development, execution, and reporting requirements for the FUDS program. This system includes data fields to indicate whether a 5-year review is required at a site, record the actual date the 5-year review was completed, and record the scheduled date of subsequent 5-year reviews, among other things. Moreover, DOD uses these data from FUDSMIS to provide information on the status of 5-year reviews at each FUDS property in its Defense Environmental Programs Annual Report to Congress. Corps policy requires the districts to enter this information in the available data fields in FUDSMIS, and the divisions also have responsibility for ensuring that the data are accurate and complete. In addition, the accuracy and completeness of FUDSMIS data on 5-year review planning is part of one of the FUDS Program Management Indicators established by the Corps to evaluate divisions' and districts' performance and to measure and demonstrate progress toward cleaning up contamination at FUDS. However, we found that the three divisions we spoke with did not consistently track 5-year reviews in FUDSMIS. Of these three divisions, officials at one division were not aware of the data fields in FUDSMIS related to 5-year reviews. Officials at the remaining two divisions told us that neither they nor their districts enter the required information on 5-year reviews because there is no way for them to later retrieve that information in a way that would be useful to them in managing their work, such as a report listing sites that require such reviews. In addition, they noted that improvements to the system are needed—particularly to (1)

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<sup>28</sup>The John Warner National Defense Authorization Act for Fiscal Year 2007 directed the Secretary of Defense to set a goal of completing site inspections by September 30, 2010, for unexploded ordnance, discarded military munitions, and munitions constituents sites at all active installations (other than operational ranges) and FUDS.

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alert them to upcoming reviews they need to conduct, (2) better track the dates that trigger the reviews, and (3) enable the generation of reports on 5-year reviews.

- *Divisions are inconsistent in their approaches to conducting 5-year reviews for sites where they are recommended but not required.* Officials in only one division told us that their districts would conduct 5-year reviews for sites where the cleanup will eventually allow unlimited use and unrestricted exposure, but where the cleanup will require more than 5 years to complete—sites for which 5-year reviews are recommended by EPA but not required. Conducting reviews under these circumstances may be important for sites where cleanup may require many years, during which information on emerging contaminants may evolve. For example, the Corps estimates that cleanup of TCE in groundwater at the former Nebraska Ordnance Plant will take more than 100 years. According to division officials, the district managing cleanup of this FUDS is in the process of finalizing the site's first IRP 5-year review, which will indicate that the remedy remains protective of human health and the environment. The 5-year review will recommend an evaluation of a newly identified exposure pathway—intrusion of TCE vapors from the subsurface into buildings—at a limited portion of the site that is currently residential. In addition, the review discusses changes in toxicity data for carcinogenic and noncarcinogenic effects of TCE. The 5-year review also evaluates the potential long-term impacts of a newly identified exposure pathway at the site—intrusion of TCE vapors from the subsurface into buildings—on the protectiveness of the remedy. Conducting 5-year reviews at this site in the future, although not required under CERCLA and the NCP, will allow the Corps the opportunity to periodically identify whether information on TCE has changed to a degree that may affect the protectiveness of the remedy.
- *5-year review reports did not always receive the required technical review by Corps' experts.* Since 1999 and 2004, Corps policy has required districts to provide their 5-year review reports for MMRP sites and IRP sites, respectively, to the Corps' Center of Expertise for comment. According to Corps officials, the Center of Expertise's staff has up-to-date technical expertise that enables them to help the districts identify and respond to potentially important changes that may occur with respect to emerging contaminants—for example, changes in contaminant standards, toxicity information, and exposure pathways, such as vapor intrusion. When conducting their technical review of the districts' 5-year review reports, specialists at the Center of Expertise are to assess whether the reports are well-documented, follow relevant guidance, such as EPA's 2001 guidance on conducting 5-year reviews, and include the necessary statement on the protectiveness of the response actions. They also are to

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evaluate how the reports address whether the assumptions used at the time of selecting the response action are still valid—such as exposure assumptions, toxicity of contaminants, and cleanup levels. Nine of the ten 5-year reviews completed for MMRP sites were completed after the Corps' 1999 policy requiring submission of review reports was issued;<sup>29</sup> however, we found that the districts in one division did not submit three of their five reports to the Center of Expertise for technical review and comment.<sup>30</sup> In addition, four of the five 5-year reviews completed for IRP sites were completed after the Corps' 2004 policy was issued, but we found that one of these four reports was not submitted for technical review and comment.

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### The Corps Infrequently Re-examines FUDS Outside of the 5-Year Review Process

The Corps has reevaluated some sites outside the 5-year review process, but these reevaluations have been infrequent, and officials told us that they have generally not been for the purpose of addressing emerging contaminants. Outside the 5-year review process, Corps districts generally only reevaluate sites at the request of state regulators or other stakeholders. For eligible FUDS properties that were previously determined to have no FUDS eligible projects or no further action required, Corps policy allows districts to re-examine up to five FUDS properties per state per year upon request by states, tribes, EPA, or other stakeholders. In responding to such requests, the Corps may review the records or other original information for the property, as well as any additional information provided by EPA, the state, or tribe concerning potential DOD contamination. However, Corps officials told us that they have not received many requests for re-examination, and the requests received by the divisions and districts we visited were generally not for the purpose of addressing emerging contaminants. For example, officials in one district told us that their re-examination of sites has mostly been in response to concerns about petroleum contamination and munitions issues.

In addition, in some instances, the Corps reports that it has re-examined certain FUDS on its own initiative. For example, in 2004, the Corps re-examined certain munitions sites to assess the potential for contamination

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<sup>29</sup>The 5-year review report for one MMRP site predates the Corps' requirement for review by the Center of Expertise. However, the Center of Expertise participated in conducting the 5-year review for this site.

<sup>30</sup>The districts in another division did not submit two of their 5-year review reports for MMRP sites to the Center of Expertise; however, at these FUDS, the Center of Expertise had participated in conducting the 5-year reviews.

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from munitions constituents, particularly lead—an emerging contaminant on DOD’s watch list<sup>31</sup>—and other heavy metals. Corps officials note that this effort was in response to an Army policy change requiring that munitions constituents be addressed as part of MMRP cleanup projects. The Corps re-examined 196 FUDS munitions sites—many of which were former small arms ranges with no issues relating to munitions or explosives of concern—that had previously been determined to have negligible risk and no need for DOD action.<sup>32</sup> We also found that one of the districts we contacted is in the process of re-examining 513 sites, beginning with records research in 2002.

While the Corps has not often re-examined FUDS outside the 5-year review process to date, DOD and Corps officials told us that they would reevaluate the need for additional response actions at sites if there were changes in information on a contaminant. If a hazardous substance release is discovered at a FUDS that was never previously addressed at the site but occurred when the site was under DOD’s jurisdiction, DOD is responsible for addressing that release in accordance with the DERP and CERCLA, regardless of whether the Corps has already completed cleanup of other releases at the site. In addition, DOD may need to initiate further response actions at a site where it has already addressed some releases and no 5-year review is required, but new information becomes available for a contaminant, to fulfill its responsibility in accordance with the DERP and CERCLA. For example, new standards may be established for such contaminants, or previously existing standards or toxicity values may be revised. In addition, new exposure pathways may be identified. Until fairly recently, vapor intrusion—the migration of volatile chemicals such as TCE from subsurface media into the indoor air of overlying buildings—was rarely evaluated as part of human health risk assessments and was not well understood. However, given the current inventory of FUDS still requiring cleanup, there may be practical limitations to re-opening sites for further cleanup. In addition, the need for DOD to re-open FUDS to

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<sup>31</sup>Lead is also a hazardous substance under CERCLA.

<sup>32</sup>More specifically, the Corps re-examined all munitions sites that had been designated as “No DOD Action Indicated” on the basis of a Risk Assessment Code score of 5 in response to revised DOD guidance. The Corps designates a FUDS in this manner if: (1) the property or project is not eligible for consideration under the FUDS program, (2) the property or project is categorically excluded from the FUDS program, or (3) the hazards found were not the result of DOD actions on or before October 17 1986, pose no threat to human health or safety or the environment, and no additional environmental restoration activities are required.

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respond to changes in information or standards for contaminants may also depend on agreements reached with EPA or state regulatory agencies.

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## **DOD Proposes Funding for Cleanup at FUDS, Active Sites, and BRAC Sites Based on DERP Goals, and Funding Is Proportional to Site Inventories**

DOD uses the same method to propose funding for cleanup at FUDS, active sites, and BRAC sites; cleanup funding is based on DERP goals and is generally proportional to the number of sites in each of these categories. Officials in the Military Departments, Defense Agencies, and FUDS program who are responsible for executing the environmental restoration activities at the sites for which they are responsible formulate cleanup budget proposals based on instructions provided in DOD's financial management regulation and DERP environmental restoration performance goals.<sup>33</sup> DOD's DERP goals include:

- reducing risk to human health and the environment;
- preparing BRAC properties to be environmentally suitable for transfer;
- having final remedies in place and completing response actions; and
- fulfilling other established milestones to demonstrate progress toward meeting program performance goals.

DERP goals are target dates representing when the current inventory of active and BRAC sites and FUDS are expected to complete the preliminary assessment phase, site inspection phase, or achieve the remedy in place or response complete (RIP/RC) milestone. In addition, Congress has required the Secretary of Defense to establish specific performance goals for MMRP sites.<sup>34</sup> A summary of these goals for the IRP and MMRP is shown in table 2.

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<sup>33</sup>DOD Financial Management Regulation 7000.14-R, October 2008.

<sup>34</sup>The most recent set of such goals is established by the John Warner National Defense Authorization Act for Fiscal Year 2007, Pub. L. No. 109-364 § 313, 120 Stat. 2083, 2138 (2006).

**Table 2: Summary of DERP Goals for IRP and MMRP**

| Cleanup phase or milestone                        | Target Year for Completing Cleanup Phase or Milestone for All Sites |  |                      |                   |  |                      |
|---|---|--|----------------------|-------------------|--|----------------------|
|   | IRP   |  |                      | MMRP              |  |                      |
|   | Active  | BRAC   | FUDS                 | Active            | BRAC   | FUDS                 |
| Preliminary assessment                            | No goal <sup>a</sup>  | No goal <sup>a</sup>   | No goal <sup>a</sup> | 2007 <sup>b</sup> | No goal  | 2007 <sup>b,f</sup>  |
| Site inspections                                  | No goal <sup>a</sup>  | No goal <sup>a</sup>   | No goal <sup>a</sup> | 2010 <sup>b</sup> | No goal  | 2010 <sup>b</sup>    |
| Remedy in place or response complete <sup>c</sup> | 2014  | 2014 (BRAC 2005) <sup>d</sup><br>2015 (Legacy BRAC) <sup>d</sup> | 2020                 | 2020              | 2009 (Legacy BRAC) <sup>b,d</sup><br>2017 (BRAC 2005) <sup>b,d</sup> | No goal <sup>e</sup> |

Source: DOD-provided data, DOD Financial Management Regulation, 7000.14-R, Vol. 2B, Ch. 13, October 2008.

<sup>a</sup>Because IRP is more mature than MMRP, DOD's goals for IRP are focused on achieving remedy in place or response complete.

<sup>b</sup>Goals for MMRP sites contained in P.L. No. 109-364 § 313, 120 Stat. 2083, 2138; DOD Financial Management Regulation 7000.14-R, Vol. 2B, Ch. 13, October 2008; and DOD Defense Environmental Programs Annual Report to Congress, FY 2008, Appendix K. The statute requires the Secretary of Defense to set a RIP/RC date for active, BRAC 2005, and FUDS.

<sup>c</sup>Remedy in place or response complete goals apply to all IRP and MMRP sites, with the exception of MMRP sites at FUDS, which do not have a RIP/RC goal yet.

<sup>d</sup>Congress enacted legislation that instituted five separate BRAC rounds in 1988, 1991, 1993, 1995, and 2005. "Legacy BRAC" refers to the base closure rounds in 1988, 1991, 1993, and 1995. The most current closures are being conducted under the "2005 BRAC" round.

<sup>e</sup>DOD has not yet set a RIP/RC date for FUDS MMRP sites. In FY 2009, the Corps is beginning to develop a long-term strategy for MMRP sites at FUDS.

<sup>f</sup>The Corps completed preliminary assessments at 99 percent of FUDS MMRP sites by the end of FY 2008.

DOD components plan cleanup actions that are required to meet these goals at the installation or site level. DOD requires components to rank their inventory of sites by relative risk to help make informed decisions about which sites to clean up first. Using these risk rankings, as well as other factors, components set more specific restoration targets each fiscal year to demonstrate progress and prepare a budget to achieve those goals and targets. The Department of the Army has established more specific performance goals for FUDS in its Environmental Cleanup Strategic Plan. For example, the Corps' goals for the FUDS IRP are to achieve RIP/RC at

- 46 percent of all 357 high-risk sites containing HTRW by the end of FY 2008,<sup>35</sup>

<sup>35</sup>The Corps achieved this goal by the end of FY 2008.

- 48 percent of all 147 medium-risk HTRW sites by the end of FY 2011, and
- all low-risk HTRW sites by the end of FY 2020.

For the FUDS MMRP, the Corps' goals are to complete

- 40 percent of the baseline site inspections by the end of FY 2008,<sup>36</sup>
- 55 percent of the baseline site inspections by the end of FY 2009,
- 100 percent of the baseline site inspections by the end of FY 2012, and
- all site inspections by the end of FY 2014.

Another factor that can influence the proposed budgets and obligations among site categories is the need to fund long-term management activities. While DOD uses the number of sites achieving RIP/RC status as a primary performance metric, sites that have reached this goal may still require long-term management and, therefore, additional funding for a number of years. Table 3 shows the completion status for active and BRAC sites and FUDS, as of the end of FY 2008. See appendix V for the completion status of these sites by component for FY 2004 through 2008.

**Table 3: Completion Status of Sites, FY 2008**

| Status of sites   | Active | BRAC  | FUDS  |
|---|--------|-------|-------|
| Sites that have reached response complete status  | 16,810 | 3,953 | 2,682 |
| Sites that have not reached response complete status                                    | 4,703  | 1,492 | 2,023 |
| Sites that have reached response complete status but still require long-term management | 760    | 440   | 55    |

Source: GAO analysis of DOD-provided data.

The data show that there are currently significantly fewer FUDS that require long-term management—and, consequently, require less funding for this activity—than do active and BRAC sites. Corps officials told us that since FUDS are located on properties that have been transferred outside DOD's control, they prefer to clean sites to allow unlimited use

<sup>36</sup>Baseline refers to the number of MMRP sites originally identified in 2004 and is the number on which the performance goals are based. The Corps achieved this goal by the end of FY 2008.

and unrestricted exposure, when possible. However, Corps officials also said that ongoing site inspections at FUDS MMRP sites indicates that more of these sites may require long-term management in the future.

DOD data show that, in applying the broad restoration goals, performance goals, and targets, cleanup funding is generally proportional to the number of sites in the active, BRAC, and FUDS site categories. Table 4 shows the total DERP inventory of sites, obligations, and proportions for FY 2008.

**Table 4: Inventory of Sites, Obligations, and Proportions, FY 2008**

|   | Active            |                        | BRAC              |                        | FUDS              |                        | Totals            |                        |
|---|-------------------|------------------------|-------------------|------------------------|-------------------|------------------------|-------------------|------------------------|
|   | Number/<br>amount | Percentage<br>of total | Number/<br>amount | Percentage<br>of total | Number/<br>amount | Percentage<br>of total | Number/<br>amount | Percentage<br>of total |
| Total number of sites                                     | 21,513            | 68                     | 5,445             | 17                     | 4,705             | 15                     | 31,663            | 100                    |
| Amount obligated (in<br>millions of dollars) <sup>a</sup> | 1,056.1           | 61                     | 440.2             | 25                     | 245.4             | 14                     | 1,741.7           | 100                    |

Source: GAO analysis of DOD provided data.

<sup>a</sup>The amounts obligated are for cleanup activities for each category under the IRP, MMRP, and Building Demolition/Debris Removal programs.

Since DERP was established, approximately \$18.4 billion dollars has been obligated for environmental cleanup at individual sites on active military bases, \$7.7 billion for cleanup at sites located on installations designated for closure under BRAC, and about \$3.7 billion to clean up FUDS sites. During FY 2004 through 2008, about \$4.8 billion was spent on environmental cleanup of sites on active bases, \$1.8 billion for cleanup at BRAC sites, and \$1.1 billion for FUDS sites.<sup>37</sup> Appendix VI provides DOD’s funding obligations and estimated costs to complete environmental cleanup by military component and program category for FY 2004 through 2008.

<sup>37</sup> All dollar amounts in this section reflect installation project funding allocated to individual sites for cleanup under the IRP, MMRP, and BD/DR programs, and do not include program management and other support costs.



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## The Corps Uses Risk-Based Criteria to Prioritize FUDS for Cleanup, but Also Considers Other Factors

The Corps uses risk-based criteria and other factors to prioritize FUDS for cleanup. Since cleanup projects or phases of work cannot all be completed in any given year with the funding the Corps receives for the FUDS program, the Corps must prioritize sites for cleanup. Based on sites' risks, as well as other factors, districts prepare annual work plans prioritizing their projects and submit these to their division, which combines the districts' work plans into a single division work plan. Divisions send their annual work plans to the Corps' headquarters, which sends the FUDS annual work plan to the Department of the Army for approval. While the risk levels of sites are a significant factor in determining cleanup priorities, high risk sites are not always addressed before low risk sites. FUDS program data indicate that, as of the end of FY 2008, 35 percent of high-risk MMRP and HTRW sites (218 of 622 sites) had achieved response complete status, compared to 28 percent of medium risk sites (86 of 303 sites) and 21 percent of low-risk sites (110 of 530 sites).<sup>38</sup>

Based on site-specific information, the Corps uses several methods to assign risk-based priority levels to sites to categorize them for cleanup. The method used depends on whether the site contains HTRW, which fall under the IRP; munitions under the MMRP; or building debris under the BD/DR program.<sup>39</sup> Consequently, the Corps may use multiple methods at a single FUDS property that contains multiple types of sites—for example, a munitions site and a hazardous waste site. According to DOD guidance, the components also use the same methods to prioritize HTRW and MMRP sites at active and BRAC installations for cleanup. Appendix VII provides information on the number of high-risk sites at FUDS and active and BRAC installations, for FY 2004 through 2008.

At HTRW sites, the Corps uses the Relative Risk Site Evaluation (RRSE) to assign a relative risk level of high, medium, or low, based on an evaluation

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<sup>38</sup>In analyzing data from FUDSMIS, we used the Corps' risk categories as follows: (1) high-risk sites are those with a Relative Risk Site Evaluation risk level of high or Risk Assessment Code score of 1 or 2; (2) medium-risk sites are those with a Relative Risk Site Evaluation level of medium or Risk Assessment Code score of 3; and (3) low-risk sites are those with a Relative Risk Site Evaluation level of low or Risk Assessment Code score of 4. We did not include containerized waste or building demolition and debris removal sites in these risk categories because the Corps has already achieved response complete status at a majority of these sites and does not include them in its high, medium, and low risk categories.

<sup>39</sup>The methods are tools to prioritize sites for cleanup—they do not represent comprehensive assessments of a site's potential risks to human health and the environment.

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of three factors for four environmental media: sediment, surface soil, surface water, and groundwater. These factors include the:

- *contaminant hazard factor*, which compares the maximum concentrations of contaminants detected to benchmark comparison values;<sup>40</sup>
- *migration pathway factor*, which summarizes the likelihood that contamination will migrate; and
- *receptor factor*, which summarizes human or ecological receptors that could be exposed to contamination.

At MMRP sites, the Corps uses the Munitions Response Site Prioritization Protocol (MRSP), which DOD began implementing in FY 2007 to assign sites a relative priority level of 1 (highest hazard) to 8 (lowest hazard) using three modules.<sup>41</sup>

- *Explosive hazard evaluation and chemical warfare materiel hazard evaluation modules*, which evaluate the presence and accessibility of these hazards and the receptors that may be affected, and
- *A health hazard evaluation module*, which evaluates chronic health and environmental hazards associated with munitions constituents—as well as incidental nonmunitions-related contaminants—and builds on the framework established in the RRSE.

According to DOD and Corps officials, the Corps is in the process of applying the MRSP to FUDS, but as of the end of FY 2008, no FUDS had been assigned a final MRSP score.<sup>42</sup> FUDS program data available on the

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<sup>40</sup>Naturally occurring contaminants are not included if they are detected within established background concentration ranges.

<sup>41</sup>If a numerical priority level is inappropriate, a site may be assigned an alternative rating of Evaluation Pending (sufficient information is not available to complete any of the three modules), No Longer Required (no longer requires prioritization because all necessary munitions responses have been completed), or No Known or Suspected Hazard (physical or historical evidence affirms that there are no known or suspected hazards associated with unexploded ordnance, discarded military munitions, or munitions constituents).

<sup>42</sup>According to DOD officials, FUDS with a Risk Assessment Code score and a response already under way will not be assigned a numerical MRSP score. In addition, DOD officials told us that the Corps is in the process of applying the MRSP scores to FUDS but because the scores have not been reviewed by the quality assurance panel, they have not been reported outside of DOD, as of the end of FY 2008.

relative risk levels of MMRP sites are based on the method used prior to implementation of the MRSPP—the Risk Assessment Code, which the Corps used to assign munitions sites a risk-based score of 1 (highest priority) to 5 (no DOD action necessary). This method evaluated potential safety hazards associated with explosives based on the severity and probability of the hazard. According to DOD and Corps officials, Risk Assessment Code scores are no longer used and are being replaced by the relative priority assigned by the MRSPP.

The Corps assigns a risk-based priority level to containerized waste sites, based on the condition and location of the storage tanks. For example, a site with known leaks or spills would have a priority of 1, while sites with tanks that are not leaking and located in urban and rural areas would have priority levels of 2 and 3, respectively. The Corps assigns a risk-based priority level to building demolition and debris removal sites, based on the location of the site and ease of access to the site. For example, a site in an urban or densely populated area and with unrestricted access would have a priority of 1, while a site in a rural area or remote island with a guarded entrance would have a priority of 9.

In addition, DOD and Corps officials told us that a small number of high-priority FUDS receive separate funding from the Corps’ headquarters—in addition to the funds they receive from the relevant district—to guarantee that cleanup at these sites is funded. These are high-risk, high-visibility sites with cleanup costs high enough to consume a district’s entire budget. According to DOD and Corps officials, the list of such sites may change from year to year. Table 5 identifies the FUDS that received such funding in FY 2008 and the Corps’ estimated costs to complete cleanup at these sites.

**Table 5: High-Priority FUDS Receiving Funding From Corps Headquarters**

Dollars in millions

| FUDS                            | Costs through FY 2008 |          |                 | Estimated costs, FY 2009 to completion |           |                  | Estimated total cost |
|---------------------------------|-----------------------|----------|-----------------|--|-----------|------------------|----------------------|
|                                 | IRP                   | MMRP     | Total           | IRP                                    | MMRP      | Total            |                      |
| Waikoloa Maneuver Area, HI      | \$0.810               | \$78.402 | <b>\$79.212</b> | \$0.0                                  | \$810.573 | <b>\$810.573</b> | <b>\$889.785</b>     |
| Spring Valley, Washington, D.C. | 65.762                | 89.243   | <b>155.005</b>  | 9.701                                  | 16.177    | <b>25.878</b>    | <b>180.883</b>       |
| Buckley Field, CO               | 0.543                 | 102.805  | <b>103.348</b>  | 0.0                                    | 41.462    | <b>41.462</b>    | <b>144.810</b>       |
| Camp Sibert, AL                 | 5.134                 | 28.422   | <b>33.556</b>   | 6.596                                  | 30.398    | <b>36.994</b>    | <b>70.550</b>        |

Source: DOD.

DOD and Corps officials told us that in addition to considering a site's risk level, the Corps sets cleanup priorities based on program goals, which have evolved over time. In the past, according to these officials, the Corps initially focused on addressing building demolition and debris removal sites and containerized waste sites—FUDS program data indicate that 81 percent of building demolition and debris removal sites and 82 percent of containerized waste sites have reached response complete status, compared to 54 percent of HTRW sites and 33 percent of MMRP sites without chemical warfare materiel. DOD officials also said that the Corps has made significant progress in completing cleanup at building demolition and debris removal sites and containerized waste sites because they can be completed quickly and at less cost. In contrast, they told us that hazardous, toxic, and radioactive sites and MMRP sites are generally larger and more complex than building demolition/debris removal sites and containerized waste sites, and require more time and investment to clean up. Table 6 shows the percentage of sites that have achieved response complete status by project category, as of the end of FY 2008.

**Table 6: Response Complete Rates by Project Category, FY 2008**

| Program category                       | Project category                                      | Number of sites | Percentage at response complete |
|--|---|-----------------|---------------------------------|
| Building Demolition and Debris Removal |   | 423             | 81                              |
| IRP                                    | Containerized hazardous, toxic, and radioactive waste | 1,278           | 82                              |
|  | Hazardous, toxic, and radioactive waste               | 1,343           | 54                              |
| MMRP                                   | Without chemical warfare materiel                     | 1,566           | 33                              |
|  | With chemical warfare materiel                        | 95              | 61                              |
| <b>Total</b>                           |   | <b>4,705</b>    | <b>57</b>                       |

Source: GAO analysis of DOD data.

According to DOD and Corps officials, containerized waste and building demolition/debris removal sites are now a low priority for the Corps because it is trying to focus on meeting DOD's goals for the FUDS program and these goals do not measure cleanup of containerized waste and building demolition sites. Specifically:

- *IRP*: DOD's goal is to reduce risk, have a remedy in place, or achieve response complete status at high, medium, and low risk sites by the end of FY 2007, 2011, and 2020, respectively. According to DOD's FY 2008 Defense Environmental Programs Annual Report to Congress, DOD did not meet its goal for high relative risk FUDS by the end of FY 2007, but is

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working aggressively to complete required cleanup actions at these sites, while mitigating potential threats to human health and the environment.

- *MMRP*: The John Warner National Defense Authorization Act for FY 2007 specified the following two goals for adoption by DOD: complete preliminary assessments by the end of FY 2007 and complete site inspections by the end of FY 2010 and complete remedy in place or response complete by a date set by the Secretary of Defense. However, because the Corps centrally funds MMRP site inspections with a budget established by the Corps' headquarters and Center of Expertise, other sites do not compete with MMRP site inspections in cleanup prioritization. By the end of FY 2008, DOD had completed preliminary assessments for 99 percent of the FUDS MMRP sites, according to DOD's FY 2008 Defense Environmental Programs Annual Report to Congress, and will reevaluate current goals at the end of FY 2010. DOD has not yet established a date for achieving remedy in place or response complete status for FUDS MMRP sites.

The Corps' headquarters sets annual performance measures for its divisions and districts—such as achieving remedy in place or response complete status at a certain number of sites each year—that can also play a role in how districts prioritize sites. For example, officials at two districts we visited told us that in order to meet the remedy in place or response complete measure, they try to focus on sites where work is already in progress and cleanup can be completed. Officials at one of these districts told us that it is not appropriate to use risk rankings exclusively in deciding which sites to clean up and that they cannot stop work on sites where actions are already under way because they face pressure to meet the cleanup performance measures. Although containerized waste sites are currently a low priority for the FUDS program, officials at this district also told us they are working on many such sites that are not high-risk, but are low-cost and can be completed in a matter of months. Similarly, officials at another district told us that once a site enters a phase of the CERCLA cleanup process, they try to complete that phase before starting work on another site. However, cleanup costs for sites can also influence the order in which districts address sites. Officials at one district told us that a high-cost site could consume the district's entire annual budget. While certain high-risk sites with high costs may receive additional funding from the Corps' headquarters, another district also told us that they may delay a cleanup action until they can allocate enough funds to complete that action.

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The Corps also recognizes in its FUDS program policy and FUDS program management plan for FY 2009 that the concerns of regulators, the Congress, and the public can influence the Corps' decisions about which sites to address first and can potentially result in decisions to fund projects that are not high-risk. For example, the Corps' FUDS program policy states that regulator involvement through Statewide Management Action Plans (SMAP) is essential to the successful implementation of the relative risk concept. The SMAP program at FUDS began in 2001, and the primary purpose of a SMAP is to involve regulators in the development of life-cycle plans for the investigation and cleanup of all FUDS properties within a state. EPA, states, and the Corps may participate in jointly developing the SMAP, which is a living document that had, among its goals, determining a statewide cleanup priority for each property and project. Of the 57 states and territories, over 30 had SMAPs or equivalent agreements, as of December 2008, according to the Association of State and Territorial Solid Waste Management Officials. In the spring of 2008, the association surveyed the states about the effectiveness of SMAPs. Based on responses from 41 states, it reported that the overall effectiveness of SMAPs varied with regard to prioritizing and funding sites for cleanup, among other things.

In addition, the Defense and State Memorandum of Agreement (DSMOA), which provides a mechanism for state or territory involvement in environmental restoration activities at DOD installations—including FUDS—and state laws and regulations play a role in how the Corps prioritizes and funds sites for cleanup. The districts record certain factors that may drive prioritization and funding of sites in the “legal drivers” data fields in FUDSMIS. Our analysis of FUDS program data for one of these legal drivers indicated that 72 percent of sites with memorandum of agreement commitments—such as DSMOAs between the Corps and state regulatory agencies—had reached response complete status, compared to 56 percent of sites without such agreements. Similarly, we found that 74 percent of sites subject to state laws and regulations requiring a response within a specified period had reached response complete status, compared to the 56 percent of sites not subject to such requirements.<sup>43</sup>

Community or public concerns, as well as owner or congressional interest, also shape the Corps' decisions on which sites to address first. In particular, officials at all four of the districts we contacted noted that

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<sup>43</sup>FUDS data analyzed, as of the end of FY 2008.

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congressional interest can influence decisions on the order in which sites are addressed. Officials at one district told us that this would not lead a medium or low-risk site to be prioritized and funded for cleanup above a high-risk site, but officials at another district and the FUDS program management plan for FY 2009 note that congressional interest could potentially result in a decision to fund a site not considered high risk. However, our analysis of FUDS program data for the congressional or owner interest legal driver showed that 59 percent of sites with this driver had reached response complete status, compared to 57 percent of sites without this legal driver. In addition, officials at one division told us that the Corps' past focus on addressing containerized waste and building demolition and debris removal projects was because these were the types of hazards that politicians wanted addressed. Moreover, DOD and Corps officials told us that the Corps may still work on these types of sites, which are currently low risk priority, if Congress or other stakeholders, such as state regulators were to demand it.

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## The Corps Has Reduced Direct Management and Support Costs for the FUDS Program and Implements Accountability Measures for these Costs

DOD and the Corps report what they consider to be management and support costs for the FUDS program as part of their overall budget proposal to the Congress. DOD and the Corps track program management and support costs, such as salaries for FUDS personnel staffed at the Corps' headquarters and the operating costs for FUDSMIS. Overall management and support costs and direct management and support costs, as a proportion of the total FUDS budget, have decreased slightly between FY 2004 and 2008, largely due to a restructuring of FUDS responsibilities among the Corps' field districts and specific DOD direction to the Corps to lower certain costs. The Corps implements several measures to ensure control over how these funds are spent, both by restricting who records expenditures in the financial management information system and assigning these funds a specific tracking code.

Federal agencies and programs are not required to use any specific definition of overhead for budgeting or reporting purposes. However, DOD's Financial Management Regulation for environmental restoration programs—including FUDS—directs that administrative and overhead expenses be identified under the "Program Management and Support" element in budget justification materials.<sup>44</sup> DOD submits a three-part budget justification request to the Congress each year for each DERP

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<sup>44</sup>DOD FMR 7000.14-R, Volume 2B, Chapter 13, October 2008.

program. The first part of the budget submission is the overall Program Management and Support budget, while the second part includes all site-specific cleanup costs, and the third part includes progress toward the DERP goals. DOD divides program management and support funding for the FUDS program into direct and indirect costs. The components of direct and indirect program management and support costs are shown in table 7.

**Table 7: Components of Direct and Indirect Program Management and Support Costs**

| <b>Components of Direct Program Management and Support Costs</b>  | <b>Components of Indirect Program Management and Support Costs</b>                     |
|---|--|
| Salaries for the Corps' headquarters staff and division personnel   | Salaries for Army headquarters contractors   |
| A limited amount of funding to district managers for program management   | Operating costs for  |
| Operating costs for FUDSMIS Remedial Action Cost Engineering and Requirements system used to calculate cost-to-complete estimates | DSMOA <sup>a</sup>   |
|   | Agency for Toxic Substances and Disease Registry <sup>b</sup>                          |
|   | SMAP <sup>c</sup>  |
|   | Restoration Advisory Boards/Technical Assistance for Public Participation <sup>d</sup> |
|   | MMRP realignment <sup>e</sup>  |
|   | FUDS Information Improvement Program   |

Source: DOD.

<sup>a</sup>The DSMOA program allows states and territories to be reimbursed for certain technical services in support of environmental restoration efforts at the DOD installations within their boundaries. The DSMOA provides a mechanism for state or territory involvement in environmental restoration activities and establishes the terms and conditions required to reimburse a state or territory for technical support.

<sup>b</sup>The Agency for Toxic Substance and Disease Registry is a subagency of the U.S. Department of Health and Human Services responsible for conducting public health assessments at all sites on or proposed for the National Priority List.

<sup>c</sup>SMAPs are used to identify and monitor environmental restoration requirements, schedules, and estimates of cost, and serve as the basis for identifying regulatory agency support requirements that fall under the DSMOA program.

<sup>d</sup>Restoration Advisory Boards are established at installations or FUDS properties that have sufficient and sustained public interest in the cleanup process so that community members can provide meaningful input in the remedy selection. The Technical Assistance for Public Program allows DOD to purchase independent technical support for the Restoration Advisory Board.

<sup>e</sup>MMRP realignment is a process that the Corps has undertaken to realign MMRP projects with the definition of Munitions Response Sites. As part of this process, the sites are being reduced in size to more manageable areas that will show the progress of site cleanup more effectively.

The following table shows the amounts obligated for all FUDS activities from FY 2004 through 2008. See appendix VIII for more detailed cost information for the FUDS program.



**Table 8: FUDS Obligations, FY 2004 through 2008**

Dollars in millions

| <b>FUDS obligations</b>                     | <b>2004</b>      | <b>2005</b>      | <b>2006</b>      | <b>2007</b>      | <b>2008</b>      |
|---|------------------|------------------|------------------|------------------|------------------|
| IRP <sup>a</sup>                            | \$156.861        | \$126.718        | \$118.873        | \$116.522        | \$129.805        |
| MMRP  | 82.806           | 94.199           | 91.482           | 102.858          | 115.545          |
| <b>Total program management and support</b> | <b>44.540</b>    | <b>44.756</b>    | <b>43.483</b>    | <b>43.393</b>    | <b>41.363</b>    |
| <b>Total obligations</b>                    | <b>\$284.207</b> | <b>\$265.673</b> | <b>\$253.838</b> | <b>\$262.773</b> | <b>\$286.713</b> |

Source: DOD-provided data.

<sup>a</sup>BD/DR obligations are included.

From FY 2004 through 2008, direct program management and support costs for the FUDS program have generally decreased, both in dollar amount and as a percentage of the overall dollars obligated for the FUDS program, largely as a result of a restructuring effort by the Corps. Table 9 shows the total amount that the Corps obligated for both direct and indirect program management and support costs and Table 10 shows both as a percentage of the total program management and support budget and as a percentage of the overall amount obligated for the FUDS budget from FY 2004 through 2008:

**Table 9: Program Management and Support Obligations for FUDS, FY 2004 through 2008**

Dollars in millions

|   | <b>2004</b>      | <b>2005</b>      | <b>2006</b>      | <b>2007</b>      | <b>2008</b>      |
|---|------------------|------------------|------------------|------------------|------------------|
| Direct                                      | \$31.252         | \$25.837         | \$20.746         | \$26.161         | \$25.812         |
| Indirect                                    | 13.288           | 18.919           | 22.737           | 17.232           | 15.551           |
| <b>Total program management and support</b> | <b>44.540</b>    | <b>44.756</b>    | <b>43.483</b>    | <b>43.393</b>    | <b>41.363</b>    |
| <b>Total FUDS</b>                           | <b>\$284.207</b> | <b>\$265.673</b> | <b>\$253.838</b> | <b>\$262.773</b> | <b>\$286.713</b> |

Source: GAO analysis of DOD data.

**Table 10: Program Management and Support Proportions for FUDS, FY 2004 through 2008**

|   | 2004         | 2005         | 2006         | 2007         | 2008         |
|---|--------------|--------------|--------------|--------------|--------------|
| <b>Program management and support obligations as a percentage of the total management and support obligations</b> |              |              |              |              |              |
| Direct  | 70.2%        | 57.7%        | 47.7%        | 60.3%        | 62.4%        |
| Indirect  | 29.8         | 42.3         | 52.3         | 39.7         | 37.6         |
| <b>Program management and support obligations as a percentage of total FUDS obligations</b>                       |              |              |              |              |              |
| Direct  | 11.0         | 9.7          | 8.2          | 10.0         | 9.0          |
| Indirect  | 4.7          | 7.1          | 9.0          | 6.6          | 5.4          |
| <b>Total</b>  | <b>15.7%</b> | <b>16.8%</b> | <b>17.1%</b> | <b>16.5%</b> | <b>14.4%</b> |

Source: GAO analysis of DOD data.

In FY 2006, the Deputy Assistant Secretary of the Army for Environmental, Safety and Occupational Health directed the FUDS program to reduce the program management and support costs of the program in order to make more funds available for cleanup projects. In addition, the Corps set goals which began taking effect in FY 2007 to reduce direct program management and support funding from FY 2006 levels. Under these goals, by the end of FY 2009, direct management and support costs need to be reduced by 25 percent of the FY 2006 funding level, and this level has to be maintained through FY 2010 and beyond. In order to achieve these goals, the Corps restructured the way the FUDS program was administered by reducing the number of districts with FUDS responsibilities from 22 districts to 14 districts. These 14 districts operate within 7 regional divisions, with 2 Corps districts with FUDS program or project management responsibilities in each Corps division. However, Corps officials told us they cannot determine the overall savings they have achieved to reduce program management and support costs. For example, they said the Corps cannot measure the reduction in full-time employees assigned to FUDS program as a reduction in program management and support costs because a variety of employees, such as those who provide legal and real estate expertise at the district level, must continue to charge their time to the FUDS program. In addition, Corps officials in the divisions and districts we visited told us that they now charge time to the FUDS program for activities that they would have charged to program management and support prior to the FUDS transformation.

Several factors help to ensure that overall program management and support funds are spent only on items the Corps has approved. In this regard, only resource managers at the Corps' headquarters are able to add money to the Corps of Engineers Financial Management System which is how money, including all program management and support funds, is

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distributed for the FUDS program. The program management and support funding is also assigned a specific code, which can be used to track its expenditures in the financial system. Additionally, each division receives only a relatively small amount of program management and support funding in relation to their overall budget for the FUDS program. Corps' officials in the divisions and districts we visited told us that these funds are critical to their operations, because they pay for manager's salaries, travel for training, and respond to administrative requests from headquarters and state regulators. Due to the limited amount of these funds, division and district FUDS managers keep close watch on them, according to Corps officials, and vigorously question any expenditure of these funds, which helps to ensure that program management and support resources are spent only on the approved items.

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## Conclusions

Although the issues we identified regarding the Corps' 5-year review process have implications for all FUDS where 5-year reviews are required or may be appropriate, they are particularly relevant to sites with emerging contaminants. As more FUDS begin to reach the cleanup phase and knowledge on emerging contaminants continues to evolve, 5-year reviews may play a more important role in identifying and responding to changes in information used in FUDS cleanup decisions, such as toxicity values and standards. The issues we identified raise concerns about the extent to which the districts and divisions (1) will record and review data on 5-year reviews in the Corps' information management systems, (2) will conduct all required 5-year reviews on time, and (3) will consistently conduct reviews when appropriate. In addition, the lack of technical review of some of these reports by the Corps' Center of Expertise raises concerns about the Corps' ability to fully identify and appropriately respond to changes, such as evolving knowledge and standards for emerging contaminants. Without timely, accurate, and complete 5-year reviews for sites and reliable information on the status of such reviews, the Corps cannot be certain that remedies at FUDS remain protective of human health and the environment and cannot adequately inform stakeholders—including the Congress, the public, and regulators—regarding actual site conditions.

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## Recommendations

To help ensure that the remedies at FUDS continue to protect human health, safety, and the environment, we are making three recommendations. We recommend that the Secretary of Defense direct the Corps to

- conduct 5-year reviews for sites where emerging contaminants are present and the cleanup will eventually allow unlimited site use and unrestricted exposure, but will require more than 5 years to complete, consistent with EPA's guidance that such reviews are appropriate, even if not required;
- modify its FUDS program information management system to allow districts to more easily track information on 5-year reviews, and take steps to ensure that the districts utilize this system to plan for 5-year reviews and track progress on completing them; and
- determine why districts have not always completed timely 5-year reviews and provided all 5-year review reports to the Center of Expertise for comment—consistent with Corps guidelines—and develop procedures and controls to address these causes.

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## Agency Comments and Our Evaluation

We provided a draft of this report to DOD for official review and comment. DOD agreed with two of our recommendations and partially agreed with one. Specifically, DOD agreed with our recommendation that the Corps modify its FUDS program information management system to allow districts to more easily track information on 5-year reviews, and take steps to ensure that the districts utilize this system to plan for 5-year reviews and track progress on completing them. DOD stated that the Army has initiated actions to modify the FUDS information management system to address the recommendation. DOD also agreed with our recommendation that the Corps determine why districts have not always completed timely 5-year reviews and provided all 5-year review reports to the Center of Expertise for comment—consistent with Corps guidelines—and develop procedures and controls to address these causes. DOD said it will ensure that the Corps conducts a review of the FUDS 5-year review process, including management, tracking, and record keeping procedures. DOD partially agreed with our recommendation that the Corps conduct 5-year reviews at FUDS where emerging contaminants are present and the cleanup will eventually allow unlimited site use and unrestricted exposure, but will require more than 5 years to complete, consistent with EPA guidance that such reviews are appropriate, even if not required. DOD said that it will ensure that the Corps conducts 5-years reviews where required by CERCLA, but did not agree to conduct the additional precautionary

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reviews that are recommended by EPA. We continue to believe that, particularly for sites where emerging contaminants are present, it is important to conduct reviews when the cleanup will eventually allow unlimited use and unrestricted exposure, but will require more than 5 years to complete. Over an extended cleanup period, information on these contaminants may evolve, and these reviews may play an important role in identifying and appropriately responding to such changes as revised toxicity values or standards and new exposure pathways. If the Corps does not conduct reviews under these circumstances, it is missing an important opportunity to evaluate whether remedies remain protective of human health and the environment and to fully inform stakeholders—including the Congress, the public and regulators—regarding actual site conditions. DOD also provided technical and clarifying comments, which we incorporated as appropriate. DOD's letter is included in appendix IX.

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We are sending copies of this report to appropriate congressional committees and the Secretary of Defense. In addition, the report will be available at no charge on our Web site at <http://www.gao.gov>.

If you or your staffs have any questions about this report, please contact me at (202) 512-3841 or [stephensonj@gao.gov](mailto:stephensonj@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix X.

A handwritten signature in black ink, reading "John B. Stephenson". The signature is fluid and cursive, with the first name "John" being the most prominent.

John B. Stephenson  
Director, Natural Resources  
and Environment

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# Appendix I: Status of Cleanup Actions at the Former Almaden Air Force Radar Station

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Between 1958 and 1980, the United States Air Force operated a radar station on approximately 100 acres atop Mt. Umunhum and Mt. Thayer near San Jose, California. In 1986, the Midpeninsula Regional Open Space District (MROSD), a California state government entity, acquired the former Almaden Air Force Station.<sup>1</sup> The property contained various structures, including radar towers, operations buildings, housing facilities, a power plant, above- and below-ground fuel storage tanks, and a sewer treatment plant. MROSD staff occupied several buildings from 1986 to 1998. A 1989 earthquake damaged some buildings, transformers, and fuel tanks.

In 1991, the U.S. Army Corps of Engineers (Corps) determined that the site was eligible for cleanup under the Formerly Used Defense Sites (FUDS) program and ranked it as high risk due to the presence of various contaminants in transformers, drums, and storage tanks. Between 1994 and 1996, the Corps removed transformers, above- and below-ground fuel storage tanks and associated piping, and drums filled with chemicals. After these removal actions, the Corps turned its attention to other FUDS in the Corps District for a number of years. In 2006, the Corps returned to remove more waste from buildings, pipes, generators, and sumps. In 2007, the Corps initiated a site inspection to determine if it had overlooked any contamination, particularly polychlorinated biphenyls (PCB) from electrical transformers and petroleum from underground storage tanks and to determine if any further remediation action is needed. Corps officials anticipated completing the investigation in 2009. From 1991 through 2008, the Corps spent \$3.5 million investigating, removing materials, and taking remedial actions at the site.

In addition to cleaning up any remaining contamination, MROSD also wanted the Corps to demolish and remove all remaining structures—many of which contain deteriorating lead-based paint and asbestos—so that it may open the site to the public for recreational use. Department of Defense (DOD) and Corps officials told us that no building demolition/debris removal can be conducted at this property because the buildings and structures were not unsafe at the time of transfer out of DOD jurisdiction. They said that MROSD is responsible for maintaining all buildings and structures on the property, beginning on the date they took

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<sup>1</sup>Midpeninsula Regional Open Space District is an independent, nonprofit California state government entity established to preserve regional open space lands in a natural condition for public enjoyment. Funding is provided through property taxes, federal and state grants, interest and rental income, donations, and note issues.

title. DOD and Corps officials also said the Defense Environmental Restoration Program (DERP) authority does not extend to the removal of buildings and structures that become unsafe after they are transferred out of DOD jurisdiction and then not maintained by the subsequent owner.<sup>2</sup>

In fiscal year (FY) 2009, MROSD requested \$4 million from Congress for economic adjustment programs, including feasibility studies, legal services, and other activities related to cleaning up the site and language in the National Defense Authorization or Appropriations Acts directing DOD to clean up the site under the Defense Base Closure and Realignment Act of 1990. No language or funding regarding Almaden was included in either law.

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<sup>2</sup>Engineering Regulation 200-3-1, May 10, 2004, paragraph 3-2.6.2.

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# Appendix II: Scope and Methodology

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To determine how the U.S. Army Corps of Engineers (Corps) addresses emerging contaminants at formerly used defense sites (FUDS), and the extent to which the Corps reevaluates sites to determine the need to address emerging contaminants, we reviewed key laws, regulations, policy, and guidance for the Department of Defense (DOD), the Department of the Army, the Corps, and the Environmental Protection Agency (EPA). We interviewed officials from DOD's Office of the Deputy Undersecretary of Defense for Installations and Environment and Chemical and Material Risk Management Directorate; the Department of the Army's Office of the Assistant Secretary of the Army for Installations and Environment and Office of the Assistant Chief of Staff for Installation Management, and the Corps Directorate of Military Programs; and EPA's Office of Solid Waste and Emergency Response and Federal Facilities Restoration and Reuse Office. We also interviewed officials at two state associations—the National Governors Association and the Association of State and Territorial Solid Waste Management Officials—to obtain their perspectives on the approaches DOD and the Corps use to address emerging contaminants. We reviewed program information obtained from FUDS program managers in four of seven Corps military divisions—the North Atlantic, Northwestern, South Atlantic, and South Pacific divisions—and 4 of the 14 districts responsible for executing the FUDS program—the New England, Omaha, Sacramento, and Savannah districts—and technical experts at the Corps' Environmental and Munitions Center of Expertise. We selected the four divisions based on (1) geographic dispersion, (2) the number of FUDS sites within each division, and (3) planned obligations for fiscal year (FY) 2009, and, within these four divisions, we selected 4 of the 8 districts with FUDS program management responsibility. We reviewed additional information from the Corps on their 5-year review process from the South Atlantic division and districts in Kansas City and Los Angeles, and examined the completed 5-year review reports from the North Atlantic, Northwestern, and South Pacific divisions.

To evaluate the Corps' process for addressing emerging contaminants and prioritizing sites for cleanup, we reviewed and analyzed the nationwide property and project data in the Corps' Formerly Used Defense Sites Management Information System (FUDSMIS) through September 30, 2008, the end of their most recent reporting cycle. We assessed the reliability of relevant fields in this database by electronically testing for obvious errors in accuracy and completeness, reviewing information about the data and the system that produced them, and interviewing agency officials knowledgeable about the data. When we found inconsistencies, we worked with DOD and Corp's officials to correct the discrepancies before



conducting our analyses. We determined that the data needed for our analyses were sufficiently reliable for the purposes of our report.

To assess DOD's process for determining funding levels for cleanup among FUDS and other sites with defense waste, we spoke with officials at the Office of the Deputy Undersecretary of Defense for Installations and Environment and officials at Corps headquarters who manage the FUDS program about how budget requirements are determined, and the targets or goals that exist for the overall Defense Environmental Restoration Program (DERP). We also reviewed DOD's budget justification documents for FY 2004 through 2009 and budget data from officials at the Office of the Deputy Undersecretary of Defense for Installations and Environment and DOD's Defense Environmental Programs Annual Report to Congress for FY 2004 through 2008.

In order to determine the Corps' criteria for prioritizing FUDS for cleanup and how closely the Corps follows these criteria, we obtained and reviewed relevant policy, guidance, laws, and regulations directing DOD's cleanup activities, including relevant risk ranking protocols for contaminated sites. We interviewed and obtained information from officials from the Office of the Deputy Undersecretary of Defense for Installation and Environment, Corps headquarters personnel in charge of managing FUDS, three of seven Corps military divisions and 4 of 14 districts responsible for executing the FUDS program, and the Corps' Environmental and Munitions Center of Expertise. We also gathered and analyzed data from FUDSMIS, as well as the Defense Environmental Programs Annual Reports to Congress. In addition, we interviewed officials at two state associations—the National Governors Association and the Association of State and Territorial Solid Waste Management Officials—to obtain their perspectives on the approaches DOD and the Corps uses to prioritize FUDS for cleanup.<sup>1</sup>

To review the components and total amounts of management and support costs for the FUDS program and how these costs have changed over time,

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<sup>1</sup>DOD officials told us that the Corps is in the process of applying the Munitions Response Site Prioritization Protocol (MRSP) scores to FUDS, but as of the end of FY 2008, no FUDS had been assigned a final MRSP score. Therefore, we used the most recently assigned Risk Assessment Code scores in our analysis of the prioritization of Military Munitions Response Program (MMRP) sites at FUDS. GAO is currently assessing how military components and the Corps use MRSP scores to prioritize and fund military munitions sites for cleanup and we expect to complete this review in 2010.

we reviewed DOD's budget justification documents for FY 2004 through 2009 and interviewed and obtained budget data from officials at the Office of the Deputy Undersecretary of Defense for Installation and Environment, who are in charge of compiling the overall DERP budget, as well as Corps officials in charge of budgeting for the FUDS program. We also reviewed relevant federal accounting standards, financial management regulations, and guidance. To determine the Corps' accountability measures for these costs, we interviewed Corps headquarters personnel in charge of managing FUDS, and conducted interviews and gathered data from three of seven Corps Divisions responsible for executing the FUDS program, and 4 of 14 Corps Districts. We did not conduct a financial audit of the FUDS program.

In addition, at the request of the committee, this report provides information on the status of the Corps' cleanup efforts at the former Almaden Air Force Station. We conducted interviews and obtained information from the Corps district and division officials in charge of cleanup at Almaden and, in addition, we visited the site and interviewed and obtained detailed site information from the current owners, the Midpeninsula Regional Open Space District.

We conducted this performance audit from September 2008 through October 2009, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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# Appendix III: Occurrence of Emerging Contaminants at Formerly Used Defense Sites with Hazardous, Toxic, and Radioactive Waste

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The Department of Defense (DOD) defines an emerging contaminant as a contaminant that (1) has a reasonably possible pathway to enter the environment; (2) presents a potential unacceptable human health or environmental risk; and (3) either does not have regulatory standards based on peer-reviewed science or has regulatory standards that are evolving due to new science, detection capabilities, or exposure pathways. Tables 10 through 13 provide information on the occurrence of emerging contaminants in groundwater, surface water, soil, and sediment at formerly used defense sites (FUDS) with hazardous, toxic, and radioactive waste (HTRW). The tables are based on the sampling information the U.S. Army Corps of Engineers used in assigning risk levels to HTRW FUDS through its Relative Risk Site Evaluation (RRSE) process.<sup>1</sup> More specifically, they include the numbers of HTRW sites where contaminants on DOD's action and watch lists<sup>2</sup> were detected and the range of the maximum concentrations detected across these sites.

The data shown in Tables 11 through 14 do not necessarily represent all FUDS where these contaminants may have been detected, for several reasons. For example:

- Some sites do not have a relative risk score. Certain sites are excluded, such as those with containerized hazardous, toxic, and radioactive waste and those that have achieved the remedy-in-place or response complete (RIP/RC) milestone. For other sites, the Corps has not completed the relative-risk site evaluation process.
- Naturally occurring contaminants are not included in the RRSE if they are detected within established background concentration ranges.
- The contaminant data used in the RRSE are collected in the early phases of the cleanup process. Based on our interviews with selected Corps divisions and districts, the extent to which districts update the RRSE later is unclear.

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<sup>1</sup>The RRSE is a tool used across DOD to evaluate the relative risk posed by a site in relation to other sites. The Corps uses the RRSE to prioritize FUDS with HTRW into three categories—high, medium, or low relative risk—based on the nature and extent of the site's contamination, the likelihood that contaminants will migrate, and potential impacts on populations and ecosystems.

<sup>2</sup>DOD's watch list identifies chemicals for which there is a potential for a regulatory change to impact DOD, and its action list is for chemicals for which there is significant potential for regulatory change to impact DOD.

**Appendix III: Occurrence of Emerging Contaminants at Formerly Used Defense Sites with Hazardous, Toxic, and Radioactive Waste**

- The Corps is testing for some of these contaminants at munitions sites as part of the MMRP site inspections—those data are not included in these tables and are not yet available.

**Table 11: Maximum Detected Concentrations of Emerging Contaminants in Groundwater at HTRW FUDS**

| DOD status  | Chemical name                 | Groundwater                          |  |                          |
|-------------|-------------------------------|--------------------------------------|--|--------------------------|
|             |                               | Number of HTRW sites with detections | Range of maximum concentrations detected (parts per billion) |                          |
| Action list | Beryllium                     | 34                                   | 0.9  | to 5,100 <sup>a</sup>    |
|             | Chromium VI                   |                                      |  |                          |
|             | Cyclotrimethylenetrinitramine | 12                                   | 1.8  | to 13,000                |
|             | Naphthalene                   | 52                                   | 0.0041   | to 98,000 <sup>a,b</sup> |
|             | Perchlorate                   |                                      |  |                          |
|             | Trichloroethylene (TCE)       | 143                                  | 0.31   | to 200,000 <sup>a</sup>  |
| Watch list  | 1,4 dioxane                   |                                      |  |                          |
|             | Cadmium and compounds         | 74                                   | 0.4  | to 8,200 <sup>a</sup>    |
|             | Cerium and compounds          |                                      |  |                          |
|             | Cobalt and compounds          | 14                                   | 0.01   | to 103,000               |
|             | Dinitrotoluene                | 2                                    | 42   | to 771 <sup>c</sup>      |
|             | Dioxins                       |                                      |  |                          |
|             | Lead compounds                | 219                                  | 0.02   | to 129,000               |
|             | Manganese and compounds       | 76                                   | 0.86   | to 3,320,000             |
|             | Nickel                        | 43                                   | 0.04   | to 273,000 <sup>a</sup>  |
|             | Perfluorooctanoic acid        |                                      |  |                          |
|             | Perfluorooctane sulfonic acid |                                      |  |                          |
|             | Sulfur hexafluoride           |                                      |  |                          |
|             | Tetrachloroethylene           | 36                                   | 0.29   | to 170,000 <sup>a</sup>  |
|             | Tungsten                      |                                      |  |                          |
|             | Tungsten alloys               |                                      |  |                          |
|             | Nanomaterials                 |                                      |  |                          |

Source: GAO analysis of Corps data from the FUDS Management Information System (FUDSMIS) on the maximum detected concentrations of contaminants used in the RRSEs for HTRW sites, as of September 30, 2008.

<sup>a</sup>FUDSMIS contained no concentration data for some contaminants in some environmental media. No information was available in FUDSMIS on the extent to which the Corps had actually tested sites for those contaminants.

<sup>b</sup>According to DOD and Corps officials, all but one FUDS where perchlorate has been detected are military munitions sites, to which the RRSE does not apply. However, Appendix IV provides information on perchlorate sampling at FUDS.

<sup>c</sup>We analyzed FUDSMIS data on contaminants using the Chemical Abstract Service numbers DOD provided for these chemicals. No such numbers exist for dioxin compounds, tungsten alloys, or nanomaterials.

**Appendix III: Occurrence of Emerging  
Contaminants at Formerly Used Defense Sites  
with Hazardous, Toxic, and Radioactive Waste**

**Table 12: Maximum Detected Concentrations of Emerging Contaminants in Surface Water at HTRW FUDS**

| DOD status  | Chemical name                 | Surface water <sup>a</sup>           |  |    |                |
|-------------|-------------------------------|--------------------------------------|--|----|----------------|
|             |                               | Number of HTRW sites with detections | Range of maximum concentrations detected (parts per billion) |    |                |
| Action list | Beryllium                     | 4                                    | 2.4  | to | 16             |
|             | Chromium VI                   |                                      |  |    | <sup>b</sup>   |
|             | Cyclotrimethylenetrinitramine | 1                                    | 1.8  | to | 1.8            |
|             | Naphthalene                   | 3                                    | 100  | to | 780            |
|             | Perchlorate                   |                                      |  |    | <sup>b,c</sup> |
|             | Trichloroethylene (TCE)       | 13                                   | 1.4  | to | 9,950          |
| Watch list  | 1,4 dioxane                   |                                      |  |    | <sup>b</sup>   |
|             | Cadmium and compounds         | 24                                   | 1.5  | to | 41,601,000     |
|             | Cerium and compounds          |                                      |  |    | <sup>b</sup>   |
|             | Cobalt and compounds          | 4                                    | 37   | to | 114            |
|             | Dinitrotoluene                |                                      |  |    | <sup>b</sup>   |
|             | Dioxins                       |                                      |  |    | <sup>d</sup>   |
|             | Lead compounds                | 69                                   | 1.5  | to | 37,000         |
|             | Manganese and compounds       | 37                                   | 9.6  | to | 14,400         |
|             | Nickel                        | 15                                   | 30.8   | to | 5,360          |
|             | Perfluorooctanoic acid        |                                      |  |    | <sup>b</sup>   |
|             | Perfluorooctane sulfonic acid |                                      |  |    | <sup>b</sup>   |
|             | Sulfur hexafluoride           |                                      |  |    | <sup>b</sup>   |
|             | Tetrachloroethylene           | 2                                    | 8  | to | 1,180          |
|             | Tungsten                      |                                      |  |    | <sup>b</sup>   |
|             | Tungsten alloys               |                                      |  |    | <sup>d</sup>   |
|             | Nanomaterials                 |                                      |  |    | <sup>d</sup>   |

Source: GAO analysis of Corps data from FUDSMIS on the maximum detected concentrations of contaminants used in the RRSEs for HTRW sites, as of September 30, 2008.

<sup>a</sup>This includes multiple types of surface water. In the few instances where a contaminant was detected in two of types of surface water, we used the larger of the two maximum concentration values.

<sup>b</sup>FUDSMIS contained no concentration data for some contaminants in some environmental media. No information was available in FUDSMIS on the extent to which the Corps had actually tested sites for those contaminants.

<sup>c</sup>According to DOD and Corps officials, all but one FUDS where perchlorate has been detected are military munitions sites, to which the RRSE does not apply. However, Appendix IV provides information on perchlorate sampling at FUDS.

<sup>d</sup>We analyzed FUDSMIS data on contaminants using the Chemical Abstract Service numbers DOD provided for these chemicals. No such numbers exist for dioxin compounds, tungsten alloys, or nanomaterials.

**Appendix III: Occurrence of Emerging  
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**Table 13: Maximum Detected Concentrations of Emerging Contaminants in Soil at HTRW FUDS**

| DOD status  | Chemical name                 | Soil                                 |  |    |                |
|-------------|-------------------------------|--------------------------------------|--|----|----------------|
|             |                               | Number of HTRW sites with detections | Range of maximum concentrations detected (parts per million) |    |                |
| Action list | Beryllium                     | 60                                   | 0.0018   | to | 5.9            |
|             | Chromium VI                   |                                      |  |    | <sup>a</sup>   |
|             | Cyclotrimethylenetrinitramine | 8                                    | 0.00015  | to | 85,600         |
|             | Naphthalene                   | 58                                   | 0.0036   | to | 2,600          |
|             | Perchlorate                   |                                      |  |    | <sup>a,b</sup> |
|             | Trichloroethylene (TCE)       | 42                                   | 0.0014   | to | 6,300          |
| Watch list  | 1,4 dioxane                   |                                      |  |    | <sup>a</sup>   |
|             | Cadmium and compounds         | 127                                  | 0.00054  | to | 22,800         |
|             | Cerium and compounds          |                                      |  |    | <sup>a</sup>   |
|             | Cobalt and compounds          | 25                                   | 1.9  | to | 125            |
|             | Dinitrotoluene                | 4                                    | 0.0012   | to | 2,708          |
|             | Dioxins                       |                                      |  |    | <sup>c</sup>   |
|             | Lead compounds                | 337                                  | 0.00152  | to | 1,080,000      |
|             | Manganese and compounds       | 64                                   | 0.584  | to | 1,940,000      |
|             | Nickel                        | 62                                   | 0.013  | to | 1,270          |
|             | Perfluorooctanoic acid        |                                      |  |    | <sup>a</sup>   |
|             | Perfluorooctane sulfonic acid |                                      |  |    | <sup>a</sup>   |
|             | Sulfur hexafluoride           |                                      |  |    | <sup>a</sup>   |
|             | Tetrachloroethylene           | 24                                   | 0.0014   | to | 12,000         |
|             | Tungsten                      |                                      |  |    | <sup>a</sup>   |
|             | Tungsten alloys               |                                      |  |    | <sup>c</sup>   |
|             | Nanomaterials                 |                                      |  |    | <sup>c</sup>   |

Source: GAO analysis of Corps data from FUDSMIS on the maximum detected concentrations of contaminants used in the RRSEs for HTRW sites, as of September 30, 2008.

<sup>a</sup>FUDSMIS contained no concentration data for some contaminants in some environmental media. No information was available in FUDSMIS on the extent to which the Corps had actually tested sites for those contaminants.

<sup>b</sup>According to DOD and Corps officials, all but one FUDS where perchlorate has been detected are military munitions sites, to which the RRSE does not apply. However, Appendix IV provides information on perchlorate sampling at FUDS.

<sup>c</sup>We analyzed FUDSMIS data on contaminants using the Chemical Abstract Service numbers DOD provided for these chemicals. No such numbers exist for dioxin compounds, tungsten alloys, or nanomaterials.

**Appendix III: Occurrence of Emerging  
Contaminants at Formerly Used Defense Sites  
with Hazardous, Toxic, and Radioactive Waste**

**Table 14: Maximum Detected Concentrations of Emerging Contaminants in Sediment at HTRW FUDS**

| DOD status  | Chemical name                 | Sediment <sup>a</sup>               |  |
|-------------|-------------------------------|-------------------------------------|--|
|             |                               | Number of HTRW sites with detection | Range of maximum concentrations detected (parts per million) |
| Action list | Beryllium                     | 17                                  | 0.51 to 85   |
|             | Chromium VI                   |                                     | <sup>b</sup>   |
|             | Cyclotrimethylenetrinitramine |                                     | <sup>b</sup>   |
|             | Naphthalene                   | 7                                   | 0.38 to 210  |
|             | Perchlorate                   |                                     | <sup>b,c</sup>   |
|             | Trichloroethylene (TCE)       | 6                                   | 0.015 to 9,900   |
| Watch list  | 1,4 dioxane                   |                                     | <sup>b</sup>   |
|             | Cadmium and compounds         | 37                                  | 0.00005 to 4,200   |
|             | Cerium and compounds          |                                     | <sup>b</sup>   |
|             | Cobalt and compounds          | 8                                   | 6.4 to 251   |
|             | Dinitrotoluene                |                                     | <sup>b</sup>   |
|             | Dioxins                       |                                     | <sup>d</sup>   |
|             | Lead compounds                | 76                                  | 0.0032 to 43,000   |
|             | Manganese and compounds       | 30                                  | 0.0214 to 7,900  |
|             | Nickel                        | 24                                  | 4.2 to 403   |
|             | Perfluorooctanoic acid        |                                     | <sup>b</sup>   |
|             | Perfluorooctane sulfonic acid |                                     | <sup>b</sup>   |
|             | Sulfur hexafluoride           |                                     | <sup>b</sup>   |
|             | Tetrachloroethylene           | 2                                   | 2.182 to 13  |
|             | Tungsten                      |                                     | <sup>b</sup>   |
|             | Tungsten alloys               |                                     | <sup>d</sup>   |
|             | Nanomaterials                 |                                     | <sup>d</sup>   |

Source: GAO analysis of Corps data from FUDSMIS on the maximum detected concentrations of contaminants used in the RRSEs for HTRW sites, as of September 30, 2008.

<sup>a</sup>This includes multiple types of sediment. In the few instances where a contaminant was detected in two of types of sediment, we used the larger of the two maximum concentration values.

<sup>b</sup>FUDSMIS contained no concentration data for some contaminants in some environmental media. No information was available in FUDSMIS on the extent to which the Corps had actually tested sites for those contaminants.

<sup>c</sup>According to DOD and Corps officials, all but one FUDS where perchlorate has been detected are military munitions sites, to which the RRSE does not apply. However, Appendix IV provides information on perchlorate sampling at FUDS.

<sup>d</sup>We analyzed FUDSMIS data on contaminants using the Chemical Abstract Service numbers DOD provided for these chemicals. No such numbers exist for dioxin compounds, tungsten alloys, or nanomaterials.

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# Appendix IV: Perchlorate and Trichloroethylene Contamination at Formerly Used Defense Sites

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## Perchlorate

Perchlorate is a chemical used in propellant for certain rockets and missiles and is also found in fireworks, road flares, automobile air bags, and other manufactured items. Perchlorate can also occur naturally and is found in certain fertilizers. Exposure to perchlorate can affect the thyroid gland by blocking the uptake of iodide and may cause developmental impairments in fetuses of pregnant women. Perchlorate has been found in drinking water sources nationwide, although the extent of perchlorate contamination was not revealed until 1997, when new analytical methods enabled measurement of perchlorate at low concentrations. According to the Environmental Protection Agency (EPA), in testing of 3,865 public water supplies between 2001 and 2005, approximately 160 systems (4.1 percent)—located in 26 states and 2 territories—had at least one detection of perchlorate at levels greater than or equal to 4 micrograms per liter ( $\mu\text{g/l}$ , or parts per billion (ppb)). In addition, the Food and Drug Administration and Centers for Disease Control and Prevention have identified perchlorate in a wide variety of foods, as well as commercially available powdered infant formulas. There are currently no federal standards for the presence of perchlorate in water.

DOD has used perchlorate in propellant for certain rockets and military missiles since the 1940s. In 2003, DOD issued an *Interim Policy on Perchlorate Sampling*, which directed DOD components to

- sample for perchlorate at any previously unexamined sites—including formerly used defense sites (FUDS)—where (1) there was a reasonable basis to suspect that a release has occurred as a result of DOD activities, and (2) a complete human exposure pathway was likely to exist; and
- consider, in determining the likelihood of perchlorate occurrence, the volume of perchlorate used or disposed and/or the intensity of perchlorate-related activities at the site.

Because of uncertainties as to the concentration at which perchlorate should be regulated, DOD, the Department of Energy, the National Aeronautics and Space Administration, and EPA asked the National Research Council to assess the potential adverse health effects of perchlorate. At the conclusion of its study in 2005, the Council recommended a reference dose of 0.7  $\mu\text{g}$  per kilogram of body weight per day, which translates to a drinking water equivalent level of 24.5 ppb. EPA adopted this recommended level and, in January 2006, directed its regional offices to use this concentration as a preliminary remediation goal when cleaning up sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and



Hazardous Substances Pollution Contingency Plan, the regulation that implements CERCLA. In response to the Council's study and EPA's new guidance, DOD updated its perchlorate policy in January 2006.<sup>1</sup> With regard to FUDS, the policy directed DOD to (1) test for perchlorate, (2) conduct a site-specific risk assessment if perchlorate levels in water exceed 24 ppb, and (3) prioritize the site for risk management if the risk assessment indicates that the perchlorate contamination could potentially result in adverse health effects. According to DOD, the sampling requirement applied to all media, and the "level of concern" of 24 ppb was intended to apply to current and potential sources of drinking water.

In December 2008, EPA issued an Interim Drinking Water Health Advisory for perchlorate, which established 15 ppb as the advisory level for perchlorate in water.<sup>2</sup> Unlike the previous level of 24.5 ppb, this new level incorporates exposure to perchlorate from food sources. In January 2009, EPA directed its regional offices to use 15 ppb as a preliminary remediation goal when cleaning up sites under CERCLA where there is an actual or potential drinking water exposure pathway and no applicable or relevant and appropriate requirements (ARAR) for perchlorate. In April 2009, DOD responded by again updating its perchlorate policy, adopting a preliminary remediation goal of 15 ppb for perchlorate where (1) there is an actual or potential drinking water exposure pathway, and (2) no ARARs exist under federal or state laws.

While EPA has taken some steps to consider regulation of perchlorate under the Safe Drinking Water Act, it issued a preliminary determination in October 2008 not to regulate the chemical in drinking water, citing the lack of a "meaningful opportunity for health risk reduction" through a national drinking water regulation. As of August 2009, EPA is considering its final regulatory determination for perchlorate and expects to issue a final health advisory concurrent with the final regulatory determination. In the absence of a federal perchlorate standard, some states have established standards for the chemical—for example, Massachusetts<sup>3</sup> and

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<sup>1</sup>*Policy on DOD Required Actions Related to Perchlorate.*

<sup>2</sup>Health Advisories serve as informal technical guidance to assist Federal, State, and local officials and managers of public or community water systems in protecting public health when emergency spills or contamination situations occur. They are not legally enforceable Federal standards and are subject to change as new information becomes available.

<sup>3</sup>Massachusetts has also established cleanup standards for perchlorate in soil and groundwater, including groundwater that is not a current or potential drinking water source.

California have promulgated drinking water standards for perchlorate. In addition, some states have established nonregulatory action levels or advisories for perchlorate.

The Corps has sampled, and is continuing to sample, for perchlorate at FUDS. As of April 2008, the Corps had sampled 95 FUDS properties for perchlorate. According to DOD data,<sup>4</sup> sampling performed at FUDS before June 2006 detected perchlorate at 13 of 32 FUDS properties sampled,<sup>5</sup> five of which had concentrations exceeding 4 ppb in water.<sup>6</sup> The Corps took action at 5 of the 13 FUDS properties where perchlorate was detected<sup>7</sup> and determined that the remaining 8 FUDS properties did not require any actions to address perchlorate. Table 15 presents data for the perchlorate sampling conducted at FUDS between June 2006 and April 2008, by environmental media.

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<sup>4</sup>DOD provided perchlorate data for sampling conducted (1) prior to June 2006, and (2) June 2006 to April 2008. Data collected prior to June 2006 were available only in summary form. Detailed data by environmental media were available for June 2006 to April 2008.

<sup>5</sup>This includes two FUDS properties where DOD has attributed perchlorate contamination to subsequent private tenants and a nearby fireworks manufacturing operation.

<sup>6</sup>DOD data for 2 of the 13 FUDS properties where perchlorate was detected did not include the concentrations detected. One of these is the property where DOD has attributed perchlorate contamination to nearby fireworks manufacturing. At the other property, DOD data indicated that perchlorate was detected above the analysis method's detection limit, but below the minimum reporting limit—the minimum value for which the analysis laboratory can provide detection results with reasonable certainty. For this property, DOD provided no numerical values for the sampling results, method detection limits, or reporting limits.

<sup>7</sup>These include the following FUDS properties: the Shumaker Naval Ammunition Depot in Arkansas, where DOD has attributed perchlorate contamination to subsequent private tenants; Spring Valley in Washington, D.C.; the Former Macon Naval Ordnance Plant in Georgia; the Sioux Army Depot in Nebraska; and the Boardman Air Force Range in Oregon.

**Table 15: Perchlorate Detections at FUDS, June 2006 to April 2008**

| Media          | Number of FUDS<br>properties<br>sampled | Number of<br>FUDS<br>properties with<br>detections | Concentrations<br>detected (ppb) |         |
|----------------|---|--|----------------------------------|---------|
|                |   |  | Minimum                          | Maximum |
| Groundwater    | 28                                      | 16   | 0.061                            | 146     |
| Surface Water  | 28                                      | 20   | 0.009                            | 7.18    |
| Drinking Water | 19                                      | 13   | 0.013                            | 1.8     |
| Soil           | 5                                       | 2  | 0.27                             | 3       |

Source: GAO analysis of DOD data.

According to DOD, there are only two FUDS properties where DOD-caused perchlorate concentrations in groundwater have exceeded EPA's and DOD's current preliminary remediation goal of 15 ppb.<sup>8</sup> Specifically:

- At the Spring Valley FUDS property in Washington, D.C., perchlorate was detected in 45 of 51 groundwater samples between June 2006 and April 2008 at concentrations ranging from 0.093 ppb to 146 ppb. Perchlorate concentrations in six samples exceeded EPA's and DOD's preliminary remediation goal of 15 ppb. During this period, perchlorate was also detected in 22 of 23 surface water samples at concentrations ranging from 0.361 ppb to 7.18 ppb.
- At the Boardman Air Force Range FUDS property in Oregon, perchlorate was detected prior to June 2006 in seven of nine groundwater samples at concentrations ranging from 0.2 ppb to 20.1 ppb, as well as at 0.34 ppb in the single surface water sample collected.

The Corps is testing FUDS for perchlorate during the site inspections currently being conducted under the Military Munitions Response Program (MMRP), which DOD established in September 2001 to address potential explosive and environmental hazards associated with munitions at active installations and FUDS. The MMRP includes sites with munitions and explosives of concern, munitions constituents, and chemical warfare material. Many of the FUDS sampled prior to FY 2007 will be resampled as part of the MMRP. According to DOD officials, sampling conducted as part

<sup>8</sup>According to DOD, the groundwater at these two properties is not currently used for drinking water.

of the FUDS MMRP site inspections, as of July 2009, had identified perchlorate in:

- 116 of 247 water samples analyzed, at concentrations ranging from 0.0088 ppb to 1.91 ppb. These samples were collected from 85 FUDS MMRP sites.
- 9 of 38 soil samples analyzed, at concentrations ranging from 0.27 ppb to 3.0 ppb. These samples were collected from 6 FUDS MMRP sites.<sup>9</sup>

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## Trichloroethylene (TCE)

TCE has been widely used as a degreasing agent in metal cleaning for industrial and maintenance processes since the 1950s. Low levels of exposure to TCE have been documented to cause headaches and difficulty concentrating. High-level exposure may cause dizziness, headaches, nausea, unconsciousness, cancer, and possibly death. TCE in groundwater can take decades to clean up—for example, cleaning up TCE at the Former Nebraska Ordnance Plant site is estimated to take 130 years. According to officials with the Corps' Center of Expertise, TCE is the most significant emerging contaminant in terms of prevalence at FUDS and is the most significant emerging contaminant in terms of the cost of cleanup at FUDS. The Corps has detected TCE at a minimum of 166 sites—15 percent of the hazardous, toxic, and radioactive waste (HTRW) sites—on 143 FUDS properties.<sup>10</sup>

EPA has regulated TCE in drinking water since 1989 with a maximum contaminant level of 5 ppb. However, concerns about this contaminant have increased in recent years. For example, in 2006, NRC reported that the evidence on carcinogenic risk and other health hazards from exposure to TCE has strengthened since 2001. New information may lead to changes in the toxicity values used to assess risks of TCE exposure. In making cleanup decisions for FUDS, the Corps uses toxicity values for contaminants in conducting assessments of a site's risks to human health and the environment. EPA's Integrated Risk Information System (IRIS), a database that contains EPA's scientific position on the potential human health effects of exposure to more than 540 chemicals, is DOD's and EPA's

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<sup>9</sup>As of July 1, 2009, final analysis reports were available for samples collected up to January 6, 2009.

<sup>10</sup>These data are based on the sampling information the Corps used in assigning risk levels to HTRW sites through its Relative Risk Site Evaluation process. For the reasons outlined in Appendix III, these data do not necessarily represent all FUDS where TCE may have been detected.

preferred source for the fundamental toxicity information needed to develop human health risk assessments. However, EPA has not finalized its IRIS assessment of the risks TCE may pose. Given EPA's ongoing assessment and different preferences among regulatory agencies, DOD has used a variety of different toxicity values in assessing risks of TCE exposure at FUDS. In January 2009, EPA issued interim guidance recommending toxicity values to use in assessing potential cancer and noncancer risks from inhalation of or oral exposure to TCE. However, EPA withdrew this guidance in April 2009, stating that the agency would further evaluate the recommendations regarding the noncancer TCE toxicity value to use in assessing the risk of inhalation exposures. DOD plans to use the interim values in the withdrawn EPA guidance, but DOD officials noted that an EPA regional office or state regulatory agency may press DOD to use a value preferred by an individual risk assessor at that agency. According to DOD, in these cases, DOD works with EPA and state officials to develop an agreed-upon value.

In addition, intrusion of TCE vapors from soil or groundwater into buildings is a relatively newly-identified exposure pathway. A federal standard exists for TCE in indoor air at places of work, but not in residences or other buildings. EPA, the Army, and DOD have issued guidance on vapor intrusion, and officials told us that the Corps evaluates the vapor intrusion pathway, when appropriate, through the site-specific risk assessment. In 2002, EPA issued its *Office of Solid Waste and Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*, which has not been finalized and, according to DOD, is not followed by all state health agencies. In 2006, the Army released its Interim Vapor Intrusion Policy for Environmental Response Actions, which established environmental response actions related to vapor intrusion modeling and investigation for existing and future buildings. It also noted that potential vapor intrusion risks in existing or future buildings will be evaluated as part of the CERCLA Five-Year Review, consistent with the guidelines in the policy, if these risks were not evaluated in the Record of Decision or Decision Document for the site. In January 2009, DOD published its *Tri-Services Handbook for the Assessment of the Vapor Intrusion Pathway*, a technical guidance manual that discusses various approaches for evaluating the vapor intrusion pathway, including information on developing and interpreting vapor intrusion investigations.

As of July 2009, DOD was revising its 2001 Defense Environmental Restoration Program Management Guidance, which will outline the

conditions under which the DOD components are instructed to evaluate whether contamination in soil or groundwater poses a potential for unacceptable risk from vapor intrusion into overlying or nearby existing structures. The revisions call for appropriate response actions for a vapor intrusion pathway in existing structures when the potential for vapor intrusion exists and “a site-specific risk assessment indicates an unacceptable risk to human health due to a release to the environment that is the responsibility of DOD and not the responsibility of any other party.” In addition, the revisions note that the DOD components are to notify non-DOD property owners in writing of potential vapor intrusion risks and, as appropriate, include this information in decision documents and/or transfer documents. Further, the revisions state that a transferee will address the potential for vapor intrusion in future structures at its own expense by adding appropriate mitigating measures during construction, and that these obligations are to be included in decisions documents and/or transfer documents for the site.

# Appendix V: Completion Status of Department of Defense Sites by Program Category and Military Component

Tables 16 through 18 show the completion status of Department of Defense (DOD) sites and those that require long-term management under the Installation Restoration Program (IRP), the Military Munitions Response Program (MMRP) and the Building Demolition/Debris Removal (BD/DR) Program by military component, for fiscal year (FY) 2004 through 2008.

**Table 16: Active Sites Cleanup Completion Status for FY 2004 through 2008**

| Number of sites   |      | Military component |       |           |                          | Total  |
|---|------|--------------------|-------|-----------|--------------------------|--------|
| Program category  | FY   | Army               | Navy  | Air Force | Defense Logistics Agency |        |
| IRP sites that have achieved response complete status <sup>a</sup>                          | 2004 | 9,296              | 2,464 | 3,173     | 333                      | 15,266 |
|   | 2005 | 9,488              | 2,574 | 3,311     | 318                      | 15,691 |
|   | 2006 | 9,568              | 2,672 | 3,471     | 324                      | 16,035 |
|   | 2007 | 9,704              | 1,217 | 3,854     | 322                      | 15,097 |
|   | 2008 | 9,775              | 2,111 | 4,049     | 325                      | 16,260 |
| IRP sites that have not achieved response complete status <sup>a</sup>                      | 2004 | 1,136              | 1,235 | 2,061     | 44                       | 4,476  |
|   | 2005 | 1,024              | 1,140 | 1,978     | 26                       | 4,168  |
|   | 2006 | 883                | 1,032 | 1,855     | 21                       | 3,791  |
|   | 2007 | 783                | 2,499 | 1,436     | 23                       | 4,741  |
|   | 2008 | 707                | 1,612 | 1,243     | 21                       | 3,583  |
| IRP sites that have achieved response complete status but remain under long term management | 2004 | 208                | 124   | 368       | 19                       | 719    |
|   | 2005 | 248                | 139   | 285       | 1                        | 673    |
|   | 2006 | 268                | 156   | 274       | 11                       | 709    |
|   | 2007 | 268                | 34    | 317       | 19                       | 638    |
|   | 2008 | 331                | 54    | 351       | 22                       | 758    |
| MMRP sites that have achieved response complete status                                      | 2004 | 51                 | 8     | 52        | 0                        | 111    |
|   | 2005 | 82                 | 16    | 60        | 0                        | 158    |
|   | 2006 | 127                | 35    | 64        | 0                        | 226    |
|   | 2007 | 195                | 31    | 111       | 0                        | 337    |
|   | 2008 | 384                | 43    | 123       | 0                        | 550    |

**Appendix V: Completion Status of  
Department of Defense Sites by Program  
Category and Military Component**

| Program category   | FY   | Military component |      |           |                          | Total |
|--|------|--------------------|------|-----------|--------------------------|-------|
|  |      | Army               | Navy | Air Force | Defense Logistics Agency |       |
| MMRP sites that have not achieved response complete status                                   | 2004 | 751                | 204  | 241       | 0                        | 1,196 |
|  | 2005 | 739                | 197  | 239       | 0                        | 1,175 |
|  | 2006 | 658                | 186  | 240       | 0                        | 1,084 |
|  | 2007 | 631                | 208  | 374       | 0                        | 1,213 |
|  | 2008 | 512                | 214  | 394       | 0                        | 1,120 |
| MMRP sites that have achieved response complete status but remain under long term management | 2004 | 0                  | 0    | 0         | 0                        | 0     |
|  | 2005 | 1                  | 0    | 0         | 0                        | 1     |
|  | 2006 | 2                  | 1    | 0         | 0                        | 3     |
|  | 2007 | 2                  | 0    | 0         | 0                        | 2     |
|  | 2008 | 2                  | 0    | 0         | 0                        | 2     |

Source: DOD data.

<sup>a</sup>BD/DR sites are included.

**Table 17: BRAC Sites Cleanup Completion Status for FY 2004 through 2008**

| Number of sites  |      |                    |      |           |                          |       |
|--|------|--------------------|------|-----------|--------------------------|-------|
| Program category   | FY   | Military component |      |           |                          | Total |
|  |      | Army               | Navy | Air Force | Defense Logistics Agency |       |
| IRP sites that have achieved response complete status <sup>a</sup> | 2004 | 1,710              | 899  | 1,073     | 153                      | 3,835 |
|  | 2005 | 1744               | 920  | 1127      | 157                      | 3,948 |
|  | 2006 | 1781               | 914  | 1179      | 157                      | 4,031 |
|  | 2007 | 1767               | 422  | 1226      | 157                      | 3,572 |
|  | 2008 | 1778               | 558  | 1260      | 157                      | 3,753 |
| IRP sites that have not complete status                            | 2004 | 181                | 164  | 641       | 11                       | 997   |
|  | 2005 | 149                | 174  | 587       | 7                        | 917   |
|  | 2006 | 186                | 210  | 576       | 7                        | 979   |
|  | 2007 | 209                | 707  | 583       | 7                        | 1,506 |
|  | 2008 | 221                | 572  | 549       | 7                        | 1,349 |



**Appendix V: Completion Status of  
Department of Defense Sites by Program  
Category and Military Component**

| Program category   | FY   | Military component |      |           |  | Defense<br>Logistics<br>Agency | Total |
|--|------|--------------------|------|-----------|--|--------------------------------|-------|
|  |      | Army               | Navy | Air Force |  |                                |       |
| IRP sites that have achieved response complete status but remain under long term management  | 2004 | 51                 | 48   | 84        |  | 0                              | 183   |
|  | 2005 | 56                 | 46   | 82        |  | 0                              | 184   |
|  | 2006 | 69                 | 40   | 272       |  | 0                              | 381   |
|  | 2007 | 80                 | 16   | 289       |  | 0                              | 385   |
|  | 2008 | 84                 | 14   | 308       |  | 17                             | 423   |
| MMRP sites that have achieved response complete status                                       | 2004 | 120                | 3    | 0         |  | 0                              | 123   |
|  | 2005 | 109                | 5    | 0         |  | 0                              | 114   |
|  | 2006 | 118                | 4    | 0         |  | 0                              | 122   |
|  | 2007 | 87                 | 1    | 92        |  | 0                              | 180   |
|  | 2008 | 93                 | 5    | 102       |  | 0                              | 200   |
| MMRP sites that have not achieved response complete status                                   | 2004 | 53                 | 16   | 126       |  | 0                              | 195   |
|  | 2005 | 64                 | 14   | 126       |  | 0                              | 204   |
|  | 2006 | 99                 | 26   | 126       |  | 0                              | 251   |
|  | 2007 | 91                 | 31   | 35        |  | 0                              | 157   |
|  | 2008 | 91                 | 27   | 25        |  | 0                              | 143   |
| MMRP sites that have achieved response complete status but remain under long term management | 2004 | 2                  | 0    | 0         |  | 0                              | 2     |
|  | 2005 | 6                  | 0    | 0         |  | 0                              | 6     |
|  | 2006 | 11                 | 0    | 0         |  | 0                              | 11    |
|  | 2007 | 9                  | 0    | 8         |  | 0                              | 17    |
|  | 2008 | 10                 | 0    | 7         |  | 0                              | 17    |

Source: DOD data.

<sup>a</sup>BD/DR sites are included.

**Appendix V: Completion Status of  
Department of Defense Sites by Program  
Category and Military Component**

**Table 18: FUDS Sites Cleanup Completion Status for FY 2004 through 2008**

| Number of sites  |           |              |
|--|-----------|--------------|
| <b>Program category</b>  | <b>FY</b> | <b>Total</b> |
| IRP sites that have achieved response complete status <sup>a</sup>                           | 2004      | <b>1,872</b> |
|  | 2005      | <b>1,887</b> |
|  | 2006      | <b>2,008</b> |
|  | 2007      | <b>2,046</b> |
|  | 2008      | <b>2,114</b> |
| IRP sites that have not achieved response complete status <sup>a</sup>                       | 2004      | <b>1,226</b> |
|  | 2005      | <b>1,123</b> |
|  | 2006      | <b>1,013</b> |
|  | 2007      | <b>988</b>   |
|  | 2008      | <b>930</b>   |
| IRP sites that have achieved response complete status but remain under long term management  | 2004      | <b>77</b>    |
|  | 2005      | <b>15</b>    |
|  | 2006      | <b>21</b>    |
|  | 2007      | <b>32</b>    |
|  | 2008      | <b>38</b>    |
| MMRP sites that have achieved response complete status                                       | 2004      | <b>804</b>   |
|  | 2005      | <b>482</b>   |
|  | 2006      | <b>473</b>   |
|  | 2007      | <b>403</b>   |
|  | 2008      | <b>568</b>   |
| MMRP sites that have not achieved response complete status                                   | 2004      | <b>969</b>   |
|  | 2005      | <b>1,176</b> |
|  | 2006      | <b>1,160</b> |
|  | 2007      | <b>1,247</b> |
|  | 2008      | <b>1,093</b> |
| MMRP sites that have achieved response complete status but remain under long term management | 2004      | <b>19</b>    |
|  | 2005      | <b>11</b>    |
|  | 2006      | <b>12</b>    |
|  | 2007      | <b>15</b>    |
|  | 2008      | <b>17</b>    |

Source: DOD data.

<sup>a</sup>BD/DR sites are included.

# Appendix VI: Department of Defense Obligations and Estimated Costs to Complete Environmental Restoration by Military Component and Program Category

Table 19 shows the Department of Defense's (DOD) obligations for cleanup at active sites for the Installation Restoration Program (IRP), the Military Munitions Response Program (MMRP), the Building Demolition/Debris Removal (BD/DR) Program, and program management and support for fiscal year (FY) 2004 through 2008.

**Table 19: DOD Obligations for Cleanup at Active Sites under the IRP, MMRP and BD/DR, FY 2004 through 2008**

Dollars in millions

| Program category                            | FY   | Military component |         |           |                          | Total <sup>a</sup> |
|---|------|--------------------|---------|-----------|--------------------------|--------------------|
|   |      | Army               | Navy    | Air Force | Defense Logistics Agency |                    |
| IRP <sup>b</sup>                            | 2004 | \$339.9            | \$214.6 | \$338.3   | \$17.9                   | <b>\$910.7</b>     |
|   | 2005 | 341.0              | 207.5   | 335.0     | 11.2                     | <b>894.7</b>       |
|   | 2006 | 329.0              | 211.6   | 348.2     | 14.6                     | <b>903.5</b>       |
|   | 2007 | 325.2              | 212.8   | 343.2     | 8.7                      | <b>889.8</b>       |
|   | 2008 | 340.1              | 219.3   | 369.6     | 8.5                      | <b>937.6</b>       |
| MMRP  | 2004 | 5.8                | 8.0     | 0.0       | 0.0                      | <b>13.8</b>        |
|   | 2005 | 6.7                | 15.1    | 13.0      | 0.0                      | <b>34.8</b>        |
|   | 2006 | 12.4               | 35.3    | 10.8      | 0.0                      | <b>58.5</b>        |
|   | 2007 | 21.3               | 40.1    | 18.6      | 0.0                      | <b>80.0</b>        |
|   | 2008 | 31.9               | 45.4    | 41.3      | 0.0                      | <b>118.6</b>       |
| Program management and support <sup>c</sup> | 2004 | —                  | —       | —         | —                        | <b>—</b>           |
|   | 2005 | 53.5               | 43.2    | 48.6      | 0.7                      | <b>146.0</b>       |
|   | 2006 | 53.8               | 49.0    | 42.1      | 4.0                      | <b>148.8</b>       |
|   | 2007 | 56.4               | 48.8    | 39.7      | 2.3                      | <b>147.1</b>       |
|   | 2008 | 65.5               | 48.3    | 45.3      | 2.8                      | <b>161.9</b>       |
| Total obligations                           | 2004 | 345.7              | 222.5   | 338.3     | 17.9                     | <b>924.5</b>       |
|   | 2005 | 401.3              | 265.9   | 396.5     | 11.8                     | <b>1,075.5</b>     |
|   | 2006 | 395.2              | 295.9   | 401.1     | 18.6                     | <b>1,110.8</b>     |
|   | 2007 | 402.8              | 301.7   | 401.5     | 11.0                     | <b>1,117.0</b>     |
|   | 2008 | 437.6              | 312.9   | 456.2     | 11.3                     | <b>1,218.0</b>     |

Source: DOD data.

<sup>a</sup>Due to rounding, subtotals may not equal total obligations.

<sup>b</sup>BD/DR obligations are included.

<sup>c</sup>Program management and support includes administrative and overhead expenses. These obligations were not reported in DOD's DERP information system until FY 2005.

**Appendix VI: Department of Defense  
Obligations and Estimated Costs to Complete  
Environmental Restoration by Military  
Component and Program Category**

Table 20 shows DOD's obligations for cleanup at installations that have been closed or are designated to be closed or realigned under the Base Realignment and Closure (BRAC) process under the IRP, MMRP, and for program management and support for FY 2004 through 2008.

**Table 20: DOD's Obligations for Cleanup at BRAC Sites under the IRP and MMRP, FY 2004 through 2008**

Dollars in millions

| Program category                            | FY   | Military component |         |           |                          | Total <sup>a</sup> |
|---|------|--------------------|---------|-----------|--------------------------|--------------------|
|   |      | Army               | Navy    | Air Force | Defense Logistics Agency |                    |
| IRP   | 2004 | \$18.3             | \$120.1 | \$146.0   | \$7.3                    | <b>\$291.7</b>     |
|   | 2005 | 56.5               | 72.5    | 100.3     | 8.3                      | <b>237.6</b>       |
|   | 2006 | 43.2               | 219.5   | 81.0      | 4.3                      | <b>348.0</b>       |
|   | 2007 | 55.2               | 163.4   | 85.4      | 5.0                      | <b>308.9</b>       |
|   | 2008 | 42.0               | 256.2   | 91.1      | 1.6                      | <b>390.8</b>       |
| MMRP  | 2004 | 22.2               | 0.6     | 0.2       | 0.0                      | <b>23.0</b>        |
|   | 2005 | 17.5               | 4.6     | 0.0       | 0.0                      | <b>22.1</b>        |
|   | 2006 | 46.1               | 6.8     | 0.0       | 0.0                      | <b>52.8</b>        |
|   | 2007 | 54.0               | 7.6     | 0.2       | 0.0                      | <b>61.8</b>        |
|   | 2008 | 22.4               | 25.2    | 1.8       | 0.0                      | <b>49.4</b>        |
| Program management and support <sup>b</sup> | 2004 | —                  | —       | —         | —                        | <b>—</b>           |
|   | 2005 | 16.1               | 25.5    | 41.7      | 0.0                      | <b>83.3</b>        |
|   | 2006 | 12.1               | 30.2    | 40.5      | 0.2                      | <b>83.0</b>        |
|   | 2007 | 13.5               | 23.8    | 29.4      | 1.0                      | <b>67.7</b>        |
|   | 2008 | 14.2               | 27.5    | 36.2      | 2.1                      | <b>80.0</b>        |
| Total obligations                           | 2004 | 40.6               | \$120.7 | 146.2     | 7.3                      | <b>314.7</b>       |
|   | 2005 | 90.1               | \$102.5 | 142.1     | 8.3                      | <b>342.9</b>       |
|   | 2006 | 101.4              | \$256.4 | 121.5     | 4.5                      | <b>483.9</b>       |
|   | 2007 | 122.7              | \$194.8 | 114.9     | 6.0                      | <b>438.3</b>       |
|   | 2008 | 78.6               | \$308.8 | 129.0     | 3.7                      | <b>520.2</b>       |

Source: DOD data.

<sup>a</sup>Due to rounding, subtotals may not equal total obligations.

<sup>b</sup>Program management and support includes administrative and overhead expenses. These obligations were not reported in DOD's DERP information system until FY 2005.

**Appendix VI: Department of Defense  
Obligations and Estimated Costs to Complete  
Environmental Restoration by Military  
Component and Program Category**

Table 21 shows DOD's obligations to clean up formerly used defense sites (FUDS) under the IRP, MMRP, and BD/DR Program, and program management and support for FY 2004 through 2008.

**Table 21: DOD's Obligations for Cleanup at FUDS under the IRP, MMRP and BD/DR, FY 2004 through 2008**

| Dollars in millions                         |      |                         |
|---|------|-------------------------|
| Program category                            | FY   | Total                   |
| IRP <sup>a</sup>                            | 2004 | <b>\$156.9</b>          |
|   | 2005 | <b>126.7</b>            |
|   | 2006 | <b>118.9</b>            |
|   | 2007 | <b>116.5</b>            |
|   | 2008 | <b>129.8</b>            |
| MMRP  | 2004 | <b>82.8</b>             |
|   | 2005 | <b>94.2</b>             |
|   | 2006 | <b>91.5</b>             |
|   | 2007 | <b>102.9</b>            |
|   | 2008 | <b>115.5</b>            |
| Program management and support <sup>b</sup> | 2004 | <b>44.5<sup>c</sup></b> |
|   | 2005 | <b>44.8</b>             |
|   | 2006 | <b>43.5</b>             |
|   | 2007 | <b>43.4</b>             |
|   | 2008 | <b>41.4</b>             |
| Total obligations                           | 2004 | <b>284.2</b>            |
|   | 2005 | <b>265.7</b>            |
|   | 2006 | <b>253.8</b>            |
|   | 2007 | <b>262.8</b>            |
|   | 2008 | <b>286.7</b>            |

Source: DOD data.

<sup>a</sup>BD/DR obligations are included.

<sup>b</sup>Program management and support includes administrative and overhead expenses.

<sup>c</sup>Program management and support obligations were not reported in DOD's DERP information system until FY 2005.

Appendix VI: Department of Defense  
Obligations and Estimated Costs to Complete  
Environmental Restoration by Military  
Component and Program Category

Table 22 shows the DOD's estimated cost to complete environmental clean up for sites located at active installations, BRAC installations, and FUDS under the IRP, MMRP, and BD/DR Program for FY 2004 through 2008.

**Table 22: DOD's Estimated Costs to Complete Environmental Cleanup for Active, BRAC, and FUDS sites by Program Category, FY 2004 through 2008**

Dollars in billions

|                           | FY   | Program category |       | Total         |
|---------------------------|------|------------------|-------|---------------|
|                           |      | IRP              | MMRP  |               |
| Active sites <sup>a</sup> | 2004 | \$9.0            | \$7.3 | <b>\$16.3</b> |
|                           | 2005 | 8.2              | 6.0   | <b>14.2</b>   |
|                           | 2006 | 7.5              | 5.1   | <b>12.6</b>   |
|                           | 2007 | 6.9              | 5.3   | <b>12.2</b>   |
|                           | 2008 | 6.3              | 4.9   | <b>11.3</b>   |
| BRAC sites                | 2004 | 2.7              | 0.5   | <b>3.2</b>    |
|                           | 2005 | 2.6              | 1.2   | <b>3.8</b>    |
|                           | 2006 | 3.0              | 0.9   | <b>3.9</b>    |
|                           | 2007 | 2.9              | 0.9   | <b>3.9</b>    |
|                           | 2008 | 2.8              | 1.0   | <b>3.7</b>    |
| FUDS <sup>a</sup>         | 2004 | 3.6              | 12.2  | <b>15.8</b>   |
|                           | 2005 | 3.5              | 12.9  | <b>16.4</b>   |
|                           | 2006 | 3.4              | 12.6  | <b>16.1</b>   |
|                           | 2007 | 3.2              | 13.0  | <b>16.3</b>   |
|                           | 2008 | 2.8              | 13.5  | <b>16.2</b>   |

Source: DOD data.

Note: Does not include program management and support costs. Totals may not add due to rounding.

<sup>a</sup>BD/DR costs estimates are included in IRP category.

# Appendix VII: Department of Defense's Inventory of Sites and Number of High Risk Sites by Military Component and Program Category

Table 23 shows the total inventory of Department of Defense (DOD) sites and number ranked high risk in the Installation Restoration Program (IRP) and the Military Munitions Response Program (MMRP) by military component, for fiscal year (FY) 2004 through 2008.

**Table 23: Inventory for Active DOD Sites, FY 2004 through 2008**

| Number of sites                               |      |                    |       |           |                          |        |
|---|------|--------------------|-------|-----------|--------------------------|--------|
| Program category                              | FY   | Military component |       |           |                          | Total  |
|   |      | Army               | Navy  | Air Force | Defense Logistics Agency |        |
| IRP <sup>a</sup>                              | 2004 | 10,432             | 3,699 | 5,234     | 377                      | 19,742 |
|   | 2005 | 10,512             | 3,714 | 5,289     | 344                      | 19,859 |
|   | 2006 | 10,451             | 3,704 | 5,326     | 345                      | 19,826 |
|   | 2007 | 10,487             | 3,716 | 5,290     | 345                      | 19,838 |
|   | 2008 | 10,482             | 3,723 | 5,292     | 346                      | 19,843 |
| MMRP  | 2004 | 802                | 212   | 293       | 0                        | 1,307  |
|   | 2005 | 821                | 213   | 299       | 0                        | 1,333  |
|   | 2006 | 785                | 221   | 304       | 0                        | 1,310  |
|   | 2007 | 826                | 239   | 485       | 0                        | 1,550  |
|   | 2008 | 896                | 257   | 517       | 0                        | 1,670  |
| Total sites                                   | 2004 | 11,234             | 3,911 | 5,527     | 377                      | 21,049 |
|   | 2005 | 11,333             | 3,927 | 5,588     | 344                      | 21,192 |
|   | 2006 | 11,236             | 3,925 | 5,630     | 345                      | 21,136 |
|   | 2007 | 11,313             | 3,955 | 5,775     | 345                      | 21,388 |
|   | 2008 | 11,378             | 3,980 | 5,809     | 346                      | 21,513 |
| IRP sites ranked as high risk <sup>b</sup>    | 2004 | 486                | 474   | 273       | 4                        | 1,237  |
|   | 2005 | 337                | 412   | 211       | 4                        | 964    |
|   | 2006 | 222                | 345   | 116       | 4                        | 687    |
|   | 2007 | 114                | 205   | 23        | 4                        | 346    |
|   | 2008 | 86                 | 189   | 9         | 3                        | 287    |
| MMRP Sites ranked as high risk <sup>b,c</sup> | 2004 | 235                | 32    | 54        | 0                        | 321    |
|   | 2005 | 236                | 31    | 54        | 0                        | 321    |
|   | 2006 | 203                | 28    | 53        | 0                        | 284    |
|   | 2007 | —                  | —     | —         | 0                        | —      |
|   | 2008 | —                  | —     | —         | 0                        | —      |

**Appendix VII: Department of Defense's  
Inventory of Sites and Number of High Risk  
Sites by Military Component and Program  
Category**

| Program category                   | FY   | Military component |      |           |                             | Total |
|------------------------------------|------|--------------------|------|-----------|-----------------------------|-------|
|                                    |      | Army               | Navy | Air Force | Defense<br>Logistics Agency |       |
| Total high risk sites <sup>c</sup> | 2004 | 721                | 506  | 327       | 4                           | 1,558 |
|                                    | 2005 | 573                | 443  | 265       | 4                           | 1,285 |
|                                    | 2006 | 425                | 373  | 169       | 4                           | 971   |
|                                    | 2007 | —                  | —    | —         | —                           | —     |
|                                    | 2008 | —                  | —    | —         | —                           | —     |

Source: DOD data.

<sup>a</sup>IRP numbers include Building Demolition/Debris Removal (BD/DR) Program sites.

<sup>b</sup>We defined risk categories as follows: IRP high risk sites are those with a relative risk site evaluation (RRSE) risk level of "high" and MMRP high risk sites are those with a risk assessment code (RAC) of 1 or 2.

<sup>c</sup>The actual number of high risk MMRP sites are incomplete after FY 2006 since DOD is transitioning to the Munitions Response Site Prioritization Protocol (MRSP) scoring system.

Table 24 shows the total inventory of Base Realignment and Closure (BRAC) sites and number ranked high risk in the IRP and the MMRP by military component, for FY 2004 through 2008.

**Table 24: Inventory for BRAC Sites, FY 2004 through 2008**

Number of sites

| Program category | FY   | Military component |       |           |                             | Total |
|------------------|------|--------------------|-------|-----------|-----------------------------|-------|
|                  |      | Army               | Navy  | Air Force | Defense<br>Logistics Agency |       |
| IRP <sup>a</sup> | 2004 | 1,891              | 1,063 | 1,714     | 164                         | 4,832 |
|                  | 2005 | 1,893              | 1,094 | 1,714     | 164                         | 4,865 |
|                  | 2006 | 1,967              | 1,124 | 1,755     | 164                         | 5,010 |
|                  | 2007 | 1,976              | 1,129 | 1,809     | 164                         | 5,078 |
|                  | 2008 | 1,999              | 1,130 | 1,809     | 164                         | 5,102 |
| MMRP             | 2004 | 173                | 19    | 126       | 0                           | 318   |
|                  | 2005 | 173                | 19    | 126       | 0                           | 318   |
|                  | 2006 | 217                | 30    | 126       | 0                           | 373   |
|                  | 2007 | 178                | 32    | 127       | 0                           | 337   |
|                  | 2008 | 184                | 32    | 127       | 0                           | 343   |
| Total sites      | 2004 | 2,064              | 1,082 | 1,840     | 164                         | 5,150 |
|                  | 2005 | 2,066              | 1,113 | 1,840     | 164                         | 5,183 |
|                  | 2006 | 2,184              | 1,154 | 1,881     | 164                         | 5,383 |
|                  | 2007 | 2,154              | 1,161 | 1,936     | 164                         | 5,415 |
|                  | 2008 | 2,183              | 1,162 | 1,936     | 164                         | 5,445 |



**Appendix VII: Department of Defense's  
Inventory of Sites and Number of High Risk  
Sites by Military Component and Program  
Category**

| Program category                   | Military component |      |      |           |                             | Total |
|------------------------------------|--------------------|------|------|-----------|-----------------------------|-------|
|                                    | FY                 | Army | Navy | Air Force | Defense<br>Logistics Agency |       |
| IRP high risk <sup>b</sup>         | 2004               | 75   | 71   | 125       | 4                           | 275   |
|                                    | 2005               | 59   | 62   | 115       | 3                           | 239   |
|                                    | 2006               | 71   | 67   | 111       | 2                           | 251   |
|                                    | 2007               | 65   | 69   | 116       | 2                           | 252   |
|                                    | 2008               | 67   | 62   | 103       | 2                           | 234   |
| MMRP high risk <sup>b,c</sup>      | 2004               | 34   | 0    | 0         | 0                           | 34    |
|                                    | 2005               | 33   | 0    | 0         | 0                           | 33    |
|                                    | 2006               | 50   | 0    | 0         | 0                           | 50    |
|                                    | 2007               | —    | —    | —         | —                           | —     |
|                                    | 2008               | —    | —    | —         | —                           | —     |
| Total high risk sites <sup>c</sup> | 2004               | 109  | 71   | 125       | 4                           | 309   |
|                                    | 2005               | 92   | 62   | 115       | 3                           | 272   |
|                                    | 2006               | 121  | 67   | 111       | 2                           | 301   |
|                                    | 2007               | —    | —    | —         | —                           | —     |
|                                    | 2008               | —    | —    | —         | —                           | —     |

Source: DOD data.

<sup>a</sup>IRP numbers include BD/DR Program sites.

<sup>b</sup>We defined risk categories as follows: IRP high risk sites are those with a relative risk site evaluation (RRSE) risk level of "high" and MMRP high risk sites are those with a risk assessment code of 1 or 2.

<sup>c</sup>The actual number of high risk MMRP sites are incomplete after FY 2006 because DOD is transitioning to the MRSPS scoring system.

Table 25 shows the total inventory of formerly used defense sites (FUDS) and number ranked high risk in the IRP and MMRP for FY 2004 through 2008.

**Table 25: Inventory for FUDS, FY 2004 through 2008**

| Number of sites  |      |       |
|------------------|------|-------|
| Program category | FY   | Total |
| IRP <sup>a</sup> | 2004 | 3,098 |
|                  | 2005 | 3,010 |
|                  | 2006 | 3,021 |
|                  | 2007 | 3,034 |
|                  | 2008 | 3,044 |
| MMRP             | 2004 | 1,773 |
|                  | 2005 | 1,658 |

**Appendix VII: Department of Defense's  
Inventory of Sites and Number of High Risk  
Sites by Military Component and Program  
Category**

| <b>Program category</b>            | <b>FY</b> | <b>Total</b> |
|------------------------------------|-----------|--------------|
|                                    | 2006      | <b>1,633</b> |
|                                    | 2007      | <b>1,650</b> |
|                                    | 2008      | <b>1,661</b> |
| Total sites                        | 2004      | <b>4,871</b> |
|                                    | 2005      | <b>4,668</b> |
|                                    | 2006      | <b>4,654</b> |
|                                    | 2007      | <b>4,684</b> |
|                                    | 2008      | <b>4,705</b> |
| IRP high risk <sup>b</sup>         | 2004      | <b>235</b>   |
|                                    | 2005      | <b>222</b>   |
|                                    | 2006      | <b>217</b>   |
|                                    | 2007      | <b>213</b>   |
|                                    | 2008      | <b>200</b>   |
| MMRP high risk <sup>b,c</sup>      | 2004      | <b>189</b>   |
|                                    | 2005      | <b>199</b>   |
|                                    | 2006      | <b>191</b>   |
|                                    | 2007      | —            |
|                                    | 2008      | —            |
| Total high risk sites <sup>c</sup> | 2004      | <b>424</b>   |
|                                    | 2005      | <b>421</b>   |
|                                    | 2006      | <b>408</b>   |
|                                    | 2007      | —            |
|                                    | 2008      | —            |

Source: DOD data.

<sup>a</sup>IRP numbers include BD/DR Program sites.

<sup>b</sup>We defined risk categories as follows: IRP high risk sites are those with a relative risk site evaluation risk level of "high" and MMRP high risk sites are those with a risk assessment code of 1 or 2.

<sup>c</sup>The actual number of high risk MMRP sites is not provided after FY 2006 because DOD is transitioning to the MRSPF scoring system.

# Appendix VIII: Formerly Used Defense Sites Program Costs Details

Table 26 shows all of the line item costs for the formerly used defense sites (FUDS) program for fiscal year (FY) 2004 through 2008. It includes expenses for the Installation Restoration Program (IRP), the Military Munitions Response Program (MMRP), Building Demolition/Debris Removal (BD/DR) Program, and all program management costs (including direct and indirect costs).

**Table 26: Total FUDS Program Obligations by Cost Component, FY 2004 through 2008**

Dollars in millions

|   | FY 2004          | FY 2005          | FY 2006          | FY 2007          | FY 2008          |
|---|------------------|------------------|------------------|------------------|------------------|
| IRP <sup>a</sup>                                      | \$156.861        | \$126.718        | \$118.873        | \$116.522        | \$129.805        |
| MMRP  | 82.806           | 94.199           | 91.482           | 102.858          | 115.545          |
| Direct Program Management                             |                  |                  |                  |                  |                  |
| Management  | 31.252           | 25.837           | 20.746           | 26.161           | 25.812           |
| Indirect Program Management and Support               |                  |                  |                  |                  |                  |
| Agency for Toxic Substances and Disease Registry      | 0.265            | 0.288            | 0.088            | 0.057            | 0.000            |
| Defense State Memorandum of Agreements (DSMOA)        | 7.636            | 5.375            | 6.000            | 8.216            | 10.696           |
| Fines <sup>b</sup>                                    | 0.000            | 0.000            | 0.000            | 0.000            | 0.000            |
| Restoration Advisory Boards                           | 0.800            | 0.755            | 0.651            | 0.514            | 0.783            |
| Technical Assistance for Public Participation         | 0.060            | 0.050            | 0.050            | 0.025            | 0.053            |
| Preliminary Assessments and Inventory Project Reports | 4.527            | 6.431            | 8.646            | 7.334            | 4.019            |
| Other <sup>c</sup>                                    | 0.000            | 6.020            | 7.302            | 1.086            | 0.000            |
| Total program management and support costs            | 44.540           | 44.756           | 43.483           | 43.393           | 41.363           |
| <b>Total<sup>d</sup></b>                              | <b>\$284.207</b> | <b>\$265.673</b> | <b>\$253.838</b> | <b>\$262.773</b> | <b>\$286.713</b> |

Source: DOD data.

Notes: The table details each cost component in the FUDS program. Management, Agency for Toxic Substances and Disease Registry, Defense State Memorandum of Agreements, Fines, Restoration Advisory Boards, Technical Assistance for Public Participation, Preliminary Assessments and Inventory Project Reports, and Other are all subcomponents of the total program management and support costs. Direct program management costs include the management line. Indirect program management costs include all others: Agency for Toxic Substances and Disease Registry, Defense State Memorandum of Agreements, Fines, Restoration Advisory Boards, Technical Assistance for Public Participation, Preliminary Assessments and Inventory Project Reports, and Other.

<sup>a</sup>BD/DR obligations are included.

<sup>b</sup>Fines can be assessed against DOD by any state regulatory agency or the Environmental Protection Agency. However, no fines have been assessed for the past five fiscal years.

<sup>c</sup>Other includes items such as innovative technology costs, MRSPP Quality Assurance panel costs, FUDS Information Improvement Plan support, Engineering Regulation update costs, MMRP guidance costs, Cost To Complete process support costs, Remedial Action Cost Engineering and Requirements application, and training support.

<sup>d</sup>Totals may not add due to rounding.

Table 26 shows the percentage of the total FUDS budget that is accounted for by each line item for FY 2004 through 2008. The subcomponents of the overall Program Management and Support budget are separately calculated as a percentage of total FUDS budget and the overall Program Management and Support budget is also calculated as a percentage of the total FUDS budget.

**Table 27: FUDS Program Cost Components as a Percentage of Total FUDS Obligations, FY 2004 through 2008**

|   | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 |
|---|---------|---------|---------|---------|---------|
| IRP <sup>a</sup>                                      | 55.2%   | 47.7%   | 46.8%   | 44.3%   | 45.3%   |
| MMRP  | 29.1    | 35.5    | 36.0    | 39.1    | 40.3    |
| Agency for Toxic Substances and Disease Registry      | 0.1     | 0.1     | 0.0     | 0.0     | 0.0     |
| Defense State Memorandum of Agreements (DSMOA)        | 2.7     | 2.0     | 2.4     | 3.1     | 3.7     |
| Fines <sup>b</sup>                                    | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |
| Management  | 11.0    | 9.7     | 8.2     | 10.0    | 9.0     |
| Restoration Advisory Boards                           | 0.3     | 0.3     | 0.3     | 0.2     | 0.3     |
| Technical Assistance for Public Participation         | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |
| Preliminary Assessments and Inventory Project Reports | 1.6     | 2.4     | 3.4     | 2.8     | 1.4     |
| Other <sup>c</sup>                                    | 0.0     | 2.3     | 2.9     | 0.4     | 0.0     |
| Total program management and support costs            | 15.7%   | 16.8%   | 17.1%   | 16.5%   | 14.4%   |

Source: GAO analysis of DOD data.

Notes: The table details each cost component in the FUDS program. Agency for Toxic Substances and Disease Registry, Defense State Memorandum of Agreements, Fines, Management, Restoration Advisory Boards, Technical Assistance for Public Participation, Preliminary Assessments and Inventory Project Reports, and Other are all subcomponents of the total program management and support costs. Direct program management costs include the management line. Indirect program management costs include all others: Agency for Toxic Substances and Disease Registry, Defense State Memorandum of Agreements, Fines, Restoration Advisory Boards, Technical Assistance for Public Participation, Preliminary Assessments and Inventory Project Reports, and Other.

<sup>a</sup>BD/DR obligations are included.

<sup>b</sup>Fines can be assessed against DOD by any state regulatory agency or the Environmental Protection Agency. However, no fines have been assessed for the past five fiscal years.

<sup>c</sup>“Other” includes items such as innovative technology costs, Munitions Response Site Prioritization Protocol Quality Assurance panel costs, FUDS Information Improvement Plan support, Engineering Regulation update costs, Military Munitions Response Program guidance costs, Cost To Complete process support costs, Remedial Action Cost Engineering and Requirements application, and training support.

# Appendix IX: Comments from the Department of Defense



ACQUISITION,  
TECHNOLOGY  
AND LOGISTICS

## OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3000

OCT 19 2009

Mr. John B. Stephenson  
Director, Natural Resources and Environment  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, D.C. 20548

Dear Mr. Stephenson:

This is the Department of Defense (DoD) response to the GAO draft report, GAO-10-46, "FORMERLY USED DEFENSE SITES: The Corps of Engineers Needs to Improve Its Process for Reviewing Completed Cleanup Remedies to Ensure Continued Protection," dated September 9, 2009 (GAO Code 360993). Detailed comments on the report recommendations are enclosed.

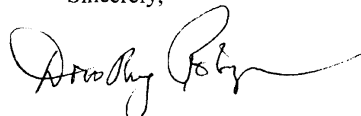
The Department partially agrees with GAO's first recommendation, that the Secretary of Defense direct the U.S. Army Corps of Engineers (Corps) to conduct 5-year reviews for sites where emerging contaminants are present. The DoD shall conduct 5-year reviews at Formerly Used Defense Sites (FUDS) where required by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Emerging contaminants that meet the CERCLA definition of a hazardous substance will be considered during those reviews as appropriate.

The Department agrees with GAO's second recommendation, that the Secretary of Defense direct the Corps to modify its formerly used defense sites (FUDS) program information management system to allow districts to more easily plan, track, and complete 5-year reviews. The Army has initiated actions to modify the FUDS information management system to address the recommendation.

The Department agrees with GAO's third recommendation, that the Secretary of Defense direct the Corps to determine why districts have not always completed timely 5-year reviews and provided all 5-year review reports to the Center of Expertise for comment, consistent with Corps guidelines, and also to develop procedures and controls to address these causes.

The Department will ensure that the Corps conducts a review of the FUDS 5-year reviews including management, tracking, and record keeping procedures.

Sincerely,

A handwritten signature in black ink, appearing to read 'Dorothy Robyn', with a long horizontal flourish extending to the right.

Dorothy Robyn  
Deputy Under Secretary of Defense  
(Installations and Environment)

Enclosure:  
As stated

GAO Draft Report Dated September 9, 2009  
GAO-10-46 (GAO CODE 360993)

**“FORMERLY USED DEFENSE SITES: The Corps of Engineers Needs to Improve  
Its Process for Reviewing Completed Cleanup Remedies to Ensure  
Continued Protection”**

**DEPARTMENT OF DEFENSE COMMENTS  
TO THE GAO RECOMMENDATIONS**

**RECOMMENDATION 1:** The GAO recommends that the Secretary of Defense direct the U.S. Army Corps of Engineers (Corps) to conduct 5-year reviews for sites where emerging contaminants are present and the cleanup will eventually allow unlimited site use and unrestricted exposure, but will require more than 5 years to complete, consistent with Environment protection Agency (EPA's) guidance that such reviews are appropriate, even if not required. (p. 39/GAO Draft Report)

**DOD RESPONSE:** Partially agree. The Department shall ensure that the Corps conducts 5-year reviews at Formerly Used Defense Sites (FUDS) where required by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Emerging contaminants that meet the CERCLA definition of a hazardous substance will be considered during those reviews as appropriate.

**RECOMMENDATION 2:** The GAO recommends that the Secretary of Defense direct the Corps to modify its formerly used defense sites (FUDS) program information management system to allow districts to more easily track information on 5-year reviews, and take steps to ensure that the districts utilize this system to plan for 5-year reviews and track progress on completing them. (p. 39/GAO Draft Report)

**DOD RESPONSE:** Agree: The Army has initiated actions to modify the FUDS information management system to address the recommendation. The Department will ensure that the modifications will allow districts to more easily track information on 5-year reviews, plan for 5-year reviews, and track progress on completing the reviews.

**RECOMMENDATION 3:** The GAO recommends that the Secretary of Defense direct the Corps to determine why districts have not always completed timely 5-year reviews and provided all 5-year review reports to the Center of Expertise for comment-consistent with Corps guidelines-and develop procedures and controls to address these causes. (p. 39/GAO Draft Report)

**DOD RESPONSE:** Agree: The Department will ensure that the Corps conducts a review of the FUDS 5-year reviews including management, tracking, and record keeping procedures.

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# Appendix X: GAO Contact and Staff Acknowledgments

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## GAO Contact

John B. Stephenson, (202) 512-3841 or [stephensonj@gao.gov](mailto:stephensonj@gao.gov)

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## Staff Acknowledgments

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